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Index to Advertisers—Page xl.

Principal Contents:

	PAGE
Coal Shipping Plant at Jarrow	351
The Factories Bill. By J. W. Thomas	353
The I.M.E.A. Convention at Brighton	354
A Works Station on the Grid	355
Medium Voltage in Houses. By T. C. Gilbert	357
Underground Sub-stations	358
Large Brickworks Adopts Electric Drive	359
Meetings and Discussions	360
Correspondence: Electricity Supply Finance; Too Many Technical Terms; What is Ohm's Law?; A National Testing Station?; Unsafe Switch Sockets; Compulsion for Contractors; The Contractors' Proposals; Testing Prepayment Meters	363
The A.S.E.E. Dinner	364
New Apparatus and Devices	365
More Coronation Equipment	366
United States Electrical Exports	367
New Books	368
Business and Industrial Notes	369
Electricity Supply	373
Traction	374
Contract Information	376
Notes	377
Our Personal Column	378
Financial Section	379
Published Specifications	383
New Work for Contractors	384

Circuit-breaker Testing

FEW subjects have been more widely discussed in electrical circles recently than the development of switchgear in relation to the increasingly exacting duties entailed by modern network operation. Readers of our columns will be aware of the many angles from which this and its associated problems can be viewed, but the outstanding points are the need to secure safety to the operator, reliability of supply and protection of apparatus.

Certain instances of switch explosions have attracted publicity during the past year or two, and the last issue of "Electrical Accidents," the Home Office annual publication, contained an informative analysis of some of these, but reasons for the intensified interest in the topic are also to be found in the proposed switchgear specification of the International Electrotechnical Commission and the descriptions published last year of two new privately owned short-circuit testing stations at Witton and Trafford Park.

The establishment of the latter was a further consequence of the failure of many attempts that have been made to secure agreement among those concerned as to the setting up of some form of national proving house—a failure that had as its first fruits the construction of the Hebburn plant seven years ago.

Arising out of an I.E.E. paper by Mr. H. W. Clothier two years later, the case for a co-operative switchgear testing station, which would free us from our dependence on foreign data, was again advanced in our columns by Mr. S. Ferguson and Mr. W. B. Woodhouse, but once more without immediate result. Now the English Electric Company announces that, as its existing arrangements for proving its range of circuit-breakers are becoming inadequate, it proposes to set up this year its own station.

The owners of these expensive plants are large concerns which are capable of keeping them fully utilised, but there are many other specialist manufacturers with well-deserved reputations, working on a smaller scale, who are not in a position to back the merits of their products with test figures. Nevertheless, there is a growing tendency to attach considerable weight to a certificate, and users and their technical advisers are naturally inclined to play for safety.

Realising the disadvantage of their present position, manufacturers without individual test facilities have now taken collective action, and the tentative proposal of the Department of Scientific and Industrial Research (on which we commented in our last issue) to establish a 250,000-kVA testing station is based upon representations received from such firms.

The cost of the provisional scheme referred to in the questionnaire that has been sent to those interested, including associations of users, is estimated at £70,000, for which annual guarantees against loss to the Government would be required from the electrical industry on much the same lines as those that were forthcoming with regard to the Yarrow ship tank at the National Physical Laboratory, which is suggested as a suitable controlling body in the present instance also.

While the provision of uniform certificates of ability to perform the duties assigned to circuit-breakers with the same factor of safety at all conditions would be an important function of the central authority, in enabling smaller firms to justify the soundness of their empirical methods based on experience, that would not be by any means the only purpose it would serve.

In our "Correspondence" columns this week Mr. G. E. Whitehead urges the importance of fundamental improvements in design. These, we believe, will be forthcoming as a result of the kind of study of arc phenomena that can be made fruitful through a skilful interpretation of records obtained when observing short circuits under controlled conditions.

For this reason one would expect a national testing station to be equipped with such instruments as would give it the status not only of a certifying authority but also of a laboratory for research to furnish data from which new developments in design could be initiated by the makers of switchgear.

Coming Events

THIS year's British Industries Fair being now an event of the past, we may, as usual, look at the electrical programme that is taking shape for the next four or five months. The various electrical institutions and associations will be holding their normal meetings as usual through March and April, with the slight interruption due to the Easter holidays. The annual meetings of E.D.A. and the P.E.A.M.A. take place a fortnight hence, while during this month and next electrical and other preparations for the Coronation will continue to occupy the attention of thousands of manufacturers, traders and contractors and their employés. It will not be the fault of this journal or of the manufacturers if electricity falls short of the opportunity that the Coronation is affording it for making the greatest demonstration in its history. The time is getting short and work at high pressure will be the general experience from now right on to the second week in May. The work special to this great occasion will then fall off, but electricity will continue to express itself in a large number of places and much that has been introduced temporarily will become more or less permanent.

A Coronation Atmosphere

THE convention proceedings arranged for the coming summer will come so soon after the actual rejoicings in London that they will undoubtedly benefit from the brilliance and general atmosphere of the great Empire event. The throng of visitors from overseas will include many electrical men—some of them are already here, the Fair having drawn them for business purposes and the Coronation as an occasion attracting them Home for obvious reasons. The I.M.E.A. Convention will open at Brighton on the last day of May and close on June 4th. In the same month (June 23rd to 25th) the Electrical Contractors' Association will meet at Blackpool, and from June 22nd to 26th there will be the annual convention of the Association of Mining Electrical Engineers at Southport. Brighton, Blackpool and Southport—what an attractive trinity of seaside resorts for the electrical man in a year of unparalleled electrical illuminations! Presumably, as usual, the I.E.E. will acquit itself well with its Home and Overseas Conversazione. The outlook for a successful season is surely very promising, even the weather, after such a miserable winter, can only be preparing to give us plenty of sunshine when it will be so much needed.

The Brighton Convention

WE are indebted to Mr. J. W. Simpson, the Secretary of the Incorporated Municipal Electrical Association, for a copy of the preliminary draft programme of the Brighton Convention. From the abstract which is published on page 354 it will be seen that after the delivery of the presidential address by Mr. F. Forrest, chief electrical engineer and manager, Birmingham, there will be a parade of electrical vehicles. Members are being urged to make full use of the exhibition. The subjects selected for the papers are electric thermal storage, the managerial aspect of an electricity supply undertaking, the development of electricity supply in rural areas and refrigeration.

Where the I.M.E.A. Stands

MR. FRANK FORREST, the president of the Incorporated Municipal Electrical Association, made a very definite declaration regarding the Association's position in a recent speech. After making a few general remarks, he said:—

"The I.M.E.A. are going to do their utmost for everyone of their undertakings, whether large or small. Many small ones must become part of larger undertakings, but we will not agree to the taking over of a local authority undertaking by a company undertaking. We will not agree even if a temporary agreement is made. There must be exactly equal terms of purchase. At present, things are in favour of the companies, for the companies can buy out a local authority cheaper than a local authority can buy out a company.

"The I.M.E.A. stands for public ownership and public control."

Action!

SINCE the report of the McGowan Committee on Electricity Distribution was published in May last year the whole of the electrical industry has been anxiously awaiting results. Nearly every week the Minister of Transport has been asked what the Government intended to do in the matter. Now, as we go to press, we learn that Mr. Hore-Belisha has announced in the House of Commons that the Report is to be acted upon, with modifications. The first aim will be to achieve some measure of standardisation of systems and lowering of costs. It is not intended to introduce a Bill this session, but to communicate to the principal interests affected an outline of legislative proposals for discussion. Schemes for the consolidation of undertakings will be prepared by the Electricity Commissioners—not by specially appointed District Commissioners as the McGowan Committee recommended. All schemes, irrespective of the size of the undertakings concerned, will have to secure the confirmation of the Minister of Transport and the approval of Parliament.

Enlightened London

ALMOST every week now sees electricity ousting gas further from London streets and houses. A recent example is the decision of the Wandsworth Borough Council to install electricity in all the houses, maisonettes and flats under its control, 1,381 dwellings being involved. It is significant that, although this will mean an increase in rent, 82 per cent. of the tenants have expressed their desire for the provision of electrical facilities.

The Paris Illuminations

IT is a great pity that London has not been able to "get together" for the Coronation illuminations to the same extent as Paris is doing for the forthcoming International Exhibition. Details are given in a later page of the colossal scheme which has been arranged by the authorities with the collaboration of a number of leading French architects. At the Exhibition itself the load will aggregate 45,000 kW, but in addition to this both banks of the Seine, prominent public buildings, the Eiffel Tower, and the river itself are to be illuminated on a most elaborate scale. All this is to be carried out in accordance with a co-ordinated plan. While thousands of kilowatts of lighting equipment will be in service in the London Coronation illuminations, the effect will be somewhat haphazard, whereas Paris will have a broad band of light right through its heart. They certainly order these things better in France, and we may yet profit from this lavish demonstration on future occasions of national celebration if it is too late now to achieve a little more co-operation for the Coronation.

The Supervisors' Opportunities

ONE advantage in the production of electric power from coal is that so large a proportion of its cost varies directly with output, whereas with water power the heavier standing charges have to be met however much the demand may vary. The significance of this in enabling this country to get through the industrial depression better than others was pointed out by Mr. W. E. Highfield at last Saturday's A.S.E.E. dinner. On the other hand, the need to meet these standing charges provides an incentive probably quite as great as that due to the low running charges of hydro-electric schemes, to secure the utmost utilisation. Utilisation as Mr. H. T. Young (Pres. I.E.E.) remarked entails an intimate knowledge of other industries as well as of our own, to acquire which the supervisors in their daily work have better chances than most. The claim of the President of the Association, Mr. H. Hobson, that increasingly wide recognition is being accorded by employés and consultants to the qualifications of its members for responsible posts is welcome evidence that this aspect is being ever more widely appreciated.

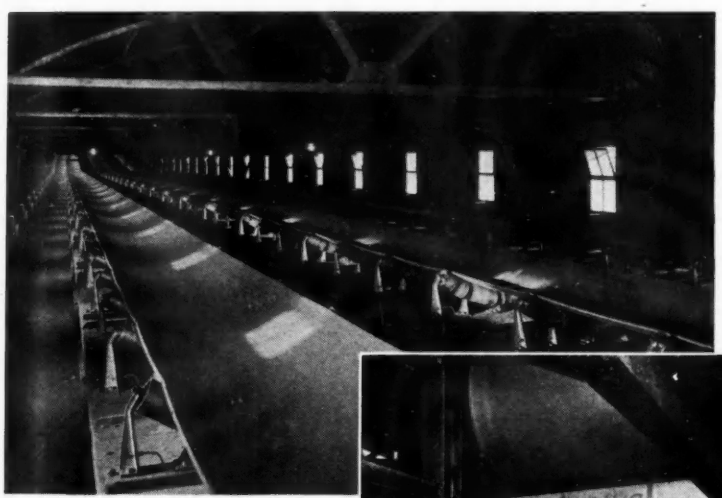
Coal Shipping Plant at Jarrow

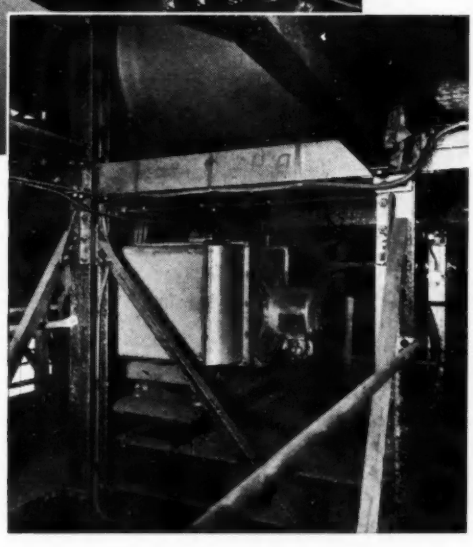
Electricity aids industrial recovery

THE latest contribution of the Tyne Improvement Commission towards general development of the River Tyne services is a new coal shipping staith at Jarrow, in connection with which Messrs. John Bowes & Partners, Ltd., are the principal shippers. The staith provides automatic coal feeding to ships at the riverside from railway sidings about 400 yards away. It consists essentially of a wharf carrying three radial-movement loading towers in which are incorporated boom conveyors fed, in two instances *via* cross conveyors, from main conveyors communicating with the hopper house at the far end. Each of three sections is a complete self-contained shipping installation from end to end.

General view of the staith

The hopper house is served by three sets of sidings—one incoming and one outgoing to each set at different levels to permit gravity marshalling of the trucks. On the lower level the truck first discharges its coal through bottom doors into a hopper below, when it is allowed to run on to the cradle of a wagon hoist. When the truck is completely on the cradle it operates a track switch which puts the hoist in motion. A slight difference in the diameters of the halves of the winding drums for the front and the back of the hoist cradle provides the necessary tilt when the wagon is at the upper level so that it will run off when released.





Main conveyor belts and (right) one of the drives

The two winding drums (one for each side of the cradle) are driven, through pinion gears on a countershaft and Wallwork worm reduction gear, by a 50-h.p. totally enclosed slip-ring motor with special fan and external air-trunk cooling arrangement which permit an acceleration to full speed, 730 r.p.m., in three seconds. The 25-ft. lift of the hoist is completed in 16½ seconds.

When the truck has run completely off the cradle at the high level it operates another track switch, which again puts the lift in motion—this time lowering. For both up and down operation the hoist motor is started direct by the corresponding track switch, while at the end of each hoist journey worm-driven limit switches stop the motor after first having reduced its speed. The whole of the control is effected through contactor gear. In the event of unsatisfactory gravity operation of the trucks there are suitably placed in the hopper house a number of Clark Chapman 1½-ton capstans with incorporated motors.

A jigging movement is imparted to each hopper by a 15-h.p. slip-ring motor with a V-belt and concentric drive, thus providing the feed on to the corresponding main belt conveyor. The three 42-in. belts are accommodated side by side in an enclosed gallery, which has a rise and fall in its 1,000-ft. length to provide for a road crossing. A 45-h.p. totally enclosed motor, situated near the river end of the gallery, drives each main belt *via* double rolls on the return side of the belt. Emergency stop switches are placed at 60-ft. spacings along the gallery. The main conveyors handle coal at the rate of 500 to 600 tons per hour.

At the river end of the main conveyors No. 1 main belt delivers its coal on to a boom conveyor, while Nos. 2 and 3 main belts feed cross conveyors which, in turn, deliver on to boom conveyors. The cross conveyors run along the river bank proper, and the three booms extend out from this line to the ships beyond the wharf. Nos. 2 and 3 cross conveyors, which are roughly 200 ft. and 700 ft. long, are driven by 12½-h.p. and 35-h.p. closed ventilated motors respectively. Each boom is incorporated in the structure of a loading tower surmounted by a 15-ton crane for handling an anti-coal-breaking equipment, and also embracing a control cabin and machinery for operating the boom, apart from the belt drive.

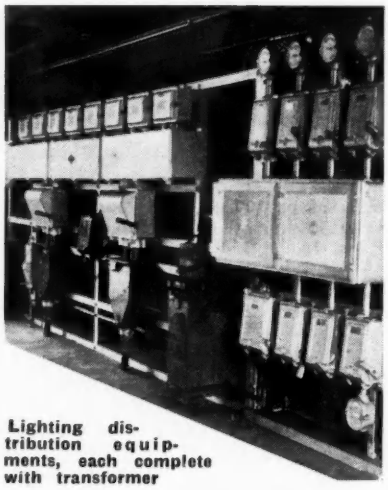
The boom is about 200 ft. long. It is pivoted at the junction with the cross conveyor or main conveyor, and a little more than half its length is stationary in relation to its tower, which travels on rails within the limits of an arc sufficient to permit coal delivery at the end of the boom to any part of the ship. The far end of boom, however, is much more flexible, having a telescopic movement within limits of 58 ft. as well as an up and down movement. At the knuckle joining the "fixed" and "movable" parts of the boom a travelling pulley accommodates the slack of the belt, in conjunction with a jockey pulley arrangement of rollers, and at this point also is the belt-driving unit—a 40-h.p. totally enclosed forced-cooled slip-ring motor. A 25-h.p. totally enclosed motor provides for the in-and-out movement of the boom, and a similarly driven equipment serves for the up-and-down movement. Each of these drives is *via* a "Radicon" worm reducing gear and simple winding drums.

The radial movement of the tower is imparted by a 30-h.p. totally enclosed slip-ring motor housed in the tower bogie and driving through heavy gears on to a track between the rails on the wharf. In addition to the solenoid brake, with which this motor is fitted in common with all the other "motion" motors, it also has a B.T.-H. Thrustor brake. To hold the back-weight of the coal-laden belts all the conveyor motors also have solenoid brakes. All the "motion" operating motors are contactor-controlled.

The anti-coal-breaker is really a portable bucket elevator which conveys large coal down into the ship's hold from the end of the boom from which it is suspended. When not in

use it rests on the side of the tower structure. It is self-contained with its 4-h.p. squirrel cage driving motor, which is supplied direct from the control room *via* a plug and socket and a trailing cable. Actually the motor only drives the conveyor in the event of a lag, the weight of the coal in the buckets normally operating it under centrifugal-governor control. Hoisting, luffing and slewing motions of the crane are served by 20-h.p., 15-h.p. and 8-h.p. slip-ring motors respectively. All the crane and boom motors are equipped for emergency limit-switch control.

The whole line of conveying equipment, from the boom to the shaker conveyor, is semi-automatically controlled in a definite sequence under supervisory control from the control cabin. First and subsequent hand-operated movements of a master controller bring into motion, in turn, the boom, cross-conveyor, main-conveyor and shaker-conveyor motors, in each case *via* relay-controlled contactors. On completion of this sequence of operations a visual signal in the control room is operated by a relay on the control panel of the shaker-conveyor motor.



Lighting distribution equipments, each complete with transformer

In addition to the master controller referred to, there are in the control cabin traction-type controllers for the crane and boom-movement motors, together with the requisite contactor and protective panels, suitably housed in metal casings, the whole equipment, apart from the actual controllers, being arranged as a composite switch and distribution board which embraces also lighting and loud-speaker signalling equipment.

In the hopper house three 10-h.p. closed-ventilated motors serve large fans, convey dust from the general atmosphere through a trunk system to three large bag containers which periodically and automatically discharge their contents on to a small totally enclosed chain conveyor which in turn delivers the dust through a steam spray on to the main conveyor belts. Five-h.p. motors drive these small chain conveyors and 2-h.p. motors operate valves in the dust-collecting system. Under automatic float control there are also two motor-driven pumps which empty sumps which collect drainage from the hopper house.

All the motors were supplied by the English Electric Co., Ltd., those, *inter alia*, for the wagon hoists, main conveyors and boom conveyors being of the closed air-circuit induction type, specially designed with inlet and outlet openings and the pipe ventilating system connected to a surface cooled radiator, while other motors, such as those for the fans, are "Closvent" equipments which have an internal fan and an outer cooling shell. All the control equipment was supplied by the Igranic Electric Co., Ltd.

Illumination of sidings, for which 500-W "Mazda" lamps in "Mazdalux" floodlight projectors are used

A loud-speaking telephone installation ("Loudaphone") supplied by Clifford & Snell (Eng.), Ltd., serves the hopper house, control cabins and the staith master's office. Communication is provided between each hopper and its own particular control cabin and also the staith master's office.

We should like to see more often the lighting of industrial plants dealt with as adequately as is the new Jarrow staith. General lighting over the area of about 750,000 sq. ft. of the railway sidings is provided by four 500-W B.T.-H. floodlighting projectors, one bracketed to the hopper house and the others suspended on poles. The spaces underneath the railway wagons whilst they are standing over the coal hoppers are lighted by Simplex prismatic fittings fixed to the girder uprights low enough and at suitable angles to project beneath the wagons.

All the conveying belt galleries are lighted by 60-W lamps in well glasses at 50-ft. intervals. There are not more than six lamps on a circuit and two-way switching provides control by an attendant in whatever direction he is walking along the gallery. On the wharf each tower is equipped with two 1,000-c.p. fittings controlled from the cabin, while the jetty deck is lighted by local lamps in well glasses at frequent intervals. At night the sign "Jarrow Staith" on the cross conveyor gallery in neon tubing shows up well from the river.

Electricity is received from the North Eastern Electric Supply Co., Ltd., at 6,000 V by duplicate feeders and is transformed to 440 V on site by two 500-kVA Parsons transformers. Reyrolle ironclad switchgear controls both h.p. and l.p. incoming and outgoing circuits, the l.p. outgoing circuits including a static condenser for power-factor correction. A brick-built sub-station houses the transformers and main switchgear.

Immediately opposite the sub-station, just across a concrete motor road and incorporated in the main conveyor gallery, is a distribution house in which l.p. feeders each serve a section of a main distribution board. Each section is complete with an English Electric main switch-fuse, a bus-bar chamber with a drop-down door, and "Artic" self-aligning fuses in totally enclosed boxes. Each of three of the sections of the distribution board serve one of the complete loading equipments, while the fourth serves auxiliary plant, including the dust equipment in the hopper house and the lighting.

Tower bogie drive; solenoid brake in front of motor

In the main sections each fuse controls just one motor and its circuit. One of the bus-bars in each section is looped through a current transformer which indicates remotely in the control cabin the electrical load, and by suitable interpretation the approximate coaling conditions for the complete section at the moment can be ascertained. All the J. & P. power cables are tough rubber sheathed and armoured.

Five lighting distribution equipments, including two in the distribution house, each incorporate separate central bus-bars, top and bottom fuses and also an English Electric 440/110-V 6.5-kW lighting transformer. Tough rubber sheathed cable in heavy tubing is employed throughout for the lighting.

An earthing system connecting all the motors and control frames throughout the installation is built up of 1¼-in. by ¼-in. strip copper, earthing plates being situated at the hopper end of each loading system, and at the pivot end of each boom conveyor. The tower bogie rails are earthed at both ends by plates in the river.

The electrical installation was carried out by Watson, Norie & Co., Ltd. (sub-contractors to Turnbull & Co.), under the supervision of Mr. W. Copeland, electrical superintendent, who was responsible to Mr. R. F. Hindmarsh, M.Inst.C.E., engineer-in-chief to the Commission, for the design of the electrical installation. We are indebted to Messrs. Hindmarsh and Copeland for their assistance.

The Factories Bill. By J. W. Thomas, LL.B., B.Sc., M.I.E.E.

A measure for codifying, amending and improving the existing law

THE Factories Bill, which was recently introduced into Parliament by the Home Secretary and is now under consideration by a House of Commons Committee, is likely, if passed into law, to be a valuable addition to our industrial legislation. It was in 1901 that the principal Act dealing with factories was passed so that the time had certainly arrived when legislation should be reviewed.

The new Bill both consolidates and revises the existing law, with the aim of bringing it more into conformity with modern standards and conditions and to provide better arrangements for securing the safety, health and welfare of factory workers, having regard to what has been learnt by experience, and from research and investigation conducted in numerous industries and by scientific bodies.

Invidious Distinctions Abolished

In the first place the Bill simplifies the existing law by abolishing various distinctions which, owing to the development of industry, have become out of date, *e.g.*, between textile factories and non-textile factories and between factories and workshops. The Act of 1901 distinguishes a factory from a workshop according to whether mechanical power is used in it or not. If mechanical power is used it is regarded as a factory, whereas if the trade is carried on by hand it is regarded as a workshop.

The endeavour to maintain this distinction to-day has led to quite a number of difficult problems and narrow points of law. The new Bill employs only the one term, "factories," and it applies to all factories whether mechanical power is used or not. The definition of "factory" is also made clearer and simpler. In the 1901 Act the definitions of "factory" and "workshop" consist largely of long schedules of specified classes of works. The new Bill (Clause 144) gives a general definition which applies to all places where persons are employed in manual labour and work is carried on by way of trade for purposes of gain for any of the following purposes—(a) The making of any article or part of any article; (b) the altering, repairing, ornamenting, finishing, cleaning or washing or the breaking up or demolition of any article; (c) the adapting for sale of any article.

This general definition will cover the bulk of works and factories but it is supplemented by the enumeration of certain classes of works for which a general definition is not regarded as adequate. Amongst them are included "any premises in which persons are employed in manual labour and in which electrical energy is generated, converted or transformed for supply by way of trade or for purposes of traction on any railway, tramway, or other means of public conveyance or for the purpose of any industrial or commercial undertaking or of any public building or for the lighting of streets or other public places." The essence of these definitions is that factories are places where persons are employed in manual labour.

Provisions Regarding Sub-stations

There is a special provision (Clause 96) applying to electrical transformer or convertor stations in which no person is regularly employed. These are to be subject to such exemptions and modifications as the Secretary of State may, by regulations, direct. Presumably the distinction between these stations and the premises defined in Clause 144 is that whereas in the latter, persons are employed regularly, in the former no one is regularly employed but the stations may be subject to intermittent visits for purposes of inspection, switching, repairs, etc. Clause 96 would, therefore, apply to transformer sub-stations and to automatic rotary sub-stations, in which there are no attendants regularly employed, but which are periodically inspected.

The use of the term "regularly" would seem to imply that both types of transformer and convertor stations must be places where persons are employed in manual labour, whether regularly or intermittently. This still leaves open the question whether transformer kiosks are factories within the meaning of the Bill. One cannot say that they are places where persons are employed in manual labour, whether regularly or not, as in many of them there is no room for a person to enter. Probably this matter will be made clearer when new regulations are framed. Open-air sub-stations, of course, are covered as they are places in which persons can enter and work. There is, in fact, a special reference to premises in the open air in Clause 144 where it is stated that premises shall not be excluded from the definition of a factory by reason only that they are open-air premises.

The Bill also covers undertakings which, at present, are not covered by the Factory Acts, *e.g.*, under the existing law if workmen are engaged upon ship construction or repair and the ship is in dry dock it is a factory, whereas if the same ship, employing corresponding labour, were lying alongside in a wet dock, it would not be a factory. Such a distinction is obviously unreal and the new Bill, therefore, provides that a factory includes operations which are carried out on a ship in harbour whether it is in dry dock or afloat. The Bill also covers undertakings carried on by local authorities which are not by way of trade or for purposes of gain.

Safeguarding Health: Lighting Requirements

The provisions of the Bill may be summarised broadly under three heads, (1) health, (2) safety, (3) welfare, but in addition it also deals with the limitation of hours so far as women and young persons are concerned.

The question of health figures prominently. The first clause contains a specific provision with regard to the general maintenance of clean conditions, the removal of dirt and the cleaning of floors. The second clause is intended to prevent overcrowding which is prejudicial to health and stipulates the amount of air space which should be allowed. Other clauses stipulate that effective provision shall be made for securing and maintaining a reasonable temperature in the workroom and indicates the temperature which is deemed to be a reasonable one for certain conditions. The Secretary of State may prescribe a standard of reasonable temperature. Effective provision shall also be made for securing adequate ventilation.

A significant and important innovation in Clause 5 provides that sufficient and suitable lighting, whether natural or artificial, shall be maintained in every part of the factory. Hitherto no requirements of any kind have been laid down by statute with regard to the lighting of factories. It is now generally recognised that the health and productivity of workers are largely dependent on proper lighting and it is a welcome sign that this has been recognised by our legislators. The provision, like many others in the Bill, is undoubtedly due to the persistent efforts which have been made for many years by factory inspectors and others who have recognised the necessity of adequate lighting.

Safety of Workers

The safety provisions are probably the best features of the Bill and certainly are of most interest to engineers. They are set out in very great detail and show that considerable care and thought have been given to framing them. A good deal of phraseology in the 1901 Act which is now antiquated and inadequate has been discarded and a freer use has been made of modern terms and descriptions.

In the first place it is provided that every fly-wheel directly connected to any prime mover and every moving part of a prime mover shall, subject to certain exceptions, be securely fenced whether situated in an engine house or not. The term "prime mover" is defined in Clause 145 as meaning every engine, motor or other appliance which provides mechanical energy derived from steam, water, wind, electricity, combustion of fuel, or other source. Also that every part of electric generators, motors and rotary convertors and every flywheel directly connected thereto shall be securely fenced unless it is in such a position or of such construction as to be as safe to every person employed or working on the premises as it would be if securely fenced. Clause 13 lays down similar requirements for the transmission machinery.

Efficient devices or appliances shall be provided and maintained in every room or place where work is carried on by which the power can promptly be cut off from the transmission gear. With regard to other machinery Clause 14 states that every dangerous part, other than prime movers and transmission machinery, shall be securely fenced unless it is in such a position or of such construction as to be as safe to every person employed or working on the premises as it would be if securely fenced.

Where, by reason of the nature of the operation, the dangerous part of any machinery cannot be secured by means of a fixed guard, it will be sufficient if a device is provided which automatically prevents the operator from coming into contact with the part.

Where the Secretary of State is satisfied that there is available and suitable for use in connection with machinery, a type of safety device which makes it impossible to expose a dangerous part of machinery whilst in motion, or stops the machinery forthwith in case of danger, he may make regulations directing that this type of device shall be provided.

In one sense the Bill is not so stringent in its requirements regarding materials or articles in motion in a machine as the 1901 Act. Courts of law have always laid it down that the obligation to fence all dangerous parts of machinery is absolute, and it has been held to be no defence to a prosecution

that such fencing was impracticable or that it would cause serious interference with the work. If a machine or part of a machine is capable of inflicting injury it must be securely fenced, and even if fencing is not practicable or if when provided it may interfere with the commercial use of the machine, it is an offence under existing law to use the machine in an unfenced condition.

The Bill, while making it obligatory that any part of a machine or any article which is dangerous while in motion in any machine shall be securely fenced, contains a proviso that this requirement shall not apply to a case where it is not practicable to comply therewith without serious interference with the work.

In determining whether any part of machinery is in such a position or of such construction as to be as safe to every person employed or working on the premises as it would be if securely fenced, no account is to be taken of any person carrying out an examination, lubrication or adjustment while the part or machinery is necessarily in motion. No person, however, under eighteen, is to be allowed to carry out such operations.

There is also a new and important provision that in any machine in a factory driven by mechanical power any set-screw, bolt, key, revolving shaft, spindle, wheel and pinion shall be so sunk or protected or, where necessary, encased so as to prevent danger. Any person who sells or lets on hire for use in a factory a machine intended to be driven by mechanical power which does not comply with the above requirement shall be guilty of an offence. This will not apply to machines made before the passing of the Act.

Boiler Construction and Operation

Clause 21 considerably extends and strengthens the provisions of the existing Act in regard to construction and maintenance of hoists and lifts and their efficient protection so as to prevent danger. New provisions also deal with the strength of chains, ropes and lifting tackle, the safe working loads to be applied to them and their periodical inspection. Cranes and other lifting machines are also made subject to similar requirements as to safe loading, maintenance, &c. Special precautions must be taken in places where dangerous fumes are liable to be present.

There are many new provisions regarding the construction, maintenance and operation of steam boilers. These deserve special study and cannot be fully summarised here. Mention ought to be made, however, of a clause which extends the safety provisions to steam receivers and containers, which may not be constructed to withstand with safety the maximum pressure of the boiler. The Bill requires that they shall have a suitable reducing valve or automatic appliance to prevent the safe working pressure being exceeded and also a safety valve to permit the steam to escape if that pressure is exceeded. The valve must be fitted either on the receiver itself or the supply pipe between the receiver and the reducing valve. Accidents have happened owing to the failure to have such appliances fitted to certain parts of generating plant and this new provision is, therefore, a very desirable one.

The Chief Inspector of Factories may, by certificate, exempt certain classes of boilers or receivers from this provision if he is satisfied that they cannot reasonably be applied.

Dangerous Trades

One of the most valuable provisions of the Act of 1901 is the section which enables the Home Secretary to make regulations for the safety of persons employed in dangerous trades. In the exercise of this power the Home Office has issued what is, in effect a series of elaborate special codes dealing with nearly forty separate trades or industries. Under the new Bill this power is extended still further, so that the Home Secretary can prohibit the employment or modify the hours of employment of workpeople in connection with any trade, manufacture or process or prohibit, limit, or control the use of any materials or method of manufacture. With regard to the notification and investigation of industrial accidents and diseases the Bill substantially reproduces the existing law.

The new measure makes an important change with regard to responsibility for the carrying out of the statutory requirements. In the existing Act it is the occupiers upon whom the obligation of compliance rests, but in the Bill it is provided that the owner, whether or not he is one of the occupiers, shall be responsible for any contravention of the provisions in the Bill dealing with overcrowding, ventilation, cleanliness, temperature and lighting. With regard to safety provisions, the occupier is generally responsible with the owner for their observance.

The powers which Courts of Summary Jurisdiction have at present to make orders as to dangerous conditions and processes are extended in the Bill. Women workers will benefit if the Bill becomes law by reason of the reduction of hours which it will bring about, and by the limitation in the amount of overtime which may be worked in a year.

Taken on the whole, the Bill represents a considerable step forward. It will effect a number of desirable reforms and, subject to certain improvements which will no doubt be made in committee, it should be welcomed by all sections of industry. It is proposed that the Bill shall come into force on July 1st, 1938.

The I.M.E.A. Convention at Brighton

AS we have already announced, this year's Convention of the Incorporated Municipal Electrical Association is to be held at Brighton from May 31st to June 4th under the presidency of Mr. F. Forrest, chief electrical engineer and manager, Birmingham. The following are the provisional arrangements:—

Monday, May 31st:—
Issue of badges at Convention office, The Dome (10 a.m. to 6 p.m.).
Official opening of Electrical Exhibition at the Corn Exchange by the Mayor of Brighton, Coun. J. Routley (3 p.m.).
President's reception at the Royal Pavilion, followed by a dance (8.15 p.m.).

Tuesday, June 1st:—
Opening of the Convention by the Mayor, followed by the presidential address (9.50 a.m.).
Parade and inspection of electric vehicles (11.15 a.m.).
A paper on "Electric Thermal Storage by Commander F. J. C. Allen and Mr. W. C. Parker, Fulham borough electrical engineer (2.30 p.m.).
Reception by the Mayor and Mayoress of Brighton at the Royal Pavilion and dancing (8.15 p.m.).

Wednesday, June 2nd:—
A paper on "Managerial Aspect of an Electricity Supply Undertaking" by Alderman E. Huntsman (10 a.m.).
Brighton Rotary Club lunch (1 p.m.). A paper on "The Development of Electricity Supply in Rural Areas," by Mr. V. A. Pask, Norwich city electrical engineer (2.30 p.m.).

Thursday, June 3rd:—
A paper on "Refrigeration" by Mr. W. F. T. Pinkney and Mr. A. J. Ryan, Hastings borough electrical engineer (10 a.m.).
Electrical Association for Women luncheon at the Grand Hotel (1 p.m.).
Reception by the President at the Exhibition (3.30 p.m.).
Annual banquet and ball at The Dome (7 for 7.30 p.m.).

Friday, June 4th:—
I.M.E.A. Council meeting (9.30 a.m.).
Extraordinary general meeting to amend Articles of Association (10.15 a.m.).
Annual general meeting (10.30 a.m.).
Visit to Shanklin, I.O.W. (2.30 p.m.).
Dance and cabaret at the Grand Hotel (9 p.m.).

All sessions will be held at the Dome and the Convention office will be situated in the vestibule. The Brighton Corporation has offered to supply each delegate with a copy of the town's brochure and street plan and these will be handed out with the badges. Delegates wearing the Convention badge will be admitted free of charge to the Aquarium; will have the free use of seats on the sea front and in the public parks;

[*Courtesy Southern Railway*
The Pavilion, Brighton

and the free use of bowling greens, tennis courts, Hollingbury Park golf course and putting greens under the control of the Corporation.

The exhibition will be open each day from May 31st to June 4th from 10 a.m. to 6 p.m.; the catalogue will be distributed with the badges.

A Works Station on the Grid

The arrangements at Port Sunlight

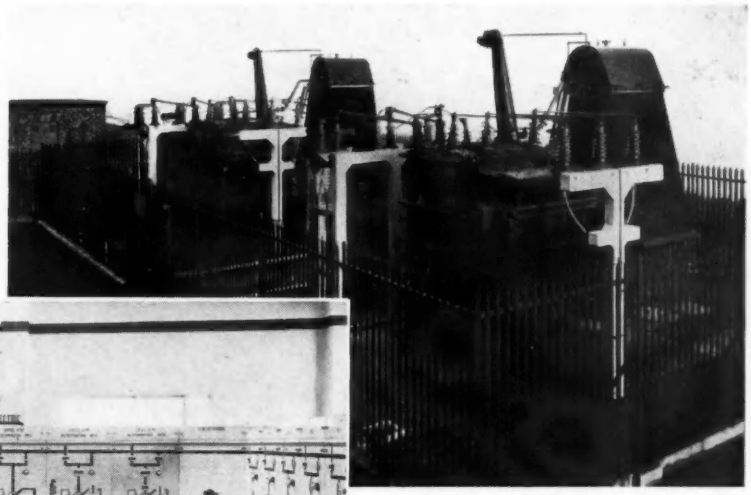
THE greater flexibility that has been introduced into the national scheme of generation by the Act of 1935 is exemplified in the arrangements made for operating the Bromborough power station of Lever Brothers, Ltd., at Port Sunlight, which is now linked up with the grid. This station contains an English Electric 6,250-kW impulse-reaction turbo-alternator and two older impulse type turbo-alternators each of 5,000-kW capacity. Steam raising is carried out by a 55,000-lb. per hr. Babcock c.t.m. boiler (the first stoker-fired unit in Europe with Bailey walls) and by three boilers, rated at 41,000 lb. per hr, each, without water-cooled walls. The largest boiler still maintains the long runs to which reference was made in an article relating to the operation of this station published in the ELECTRICAL REVIEW of January 1st, 1932, three months with the aid of Diamond soot blowers being quite an ordinary period between the times when the boiler is taken out of commission for cleaning purposes.

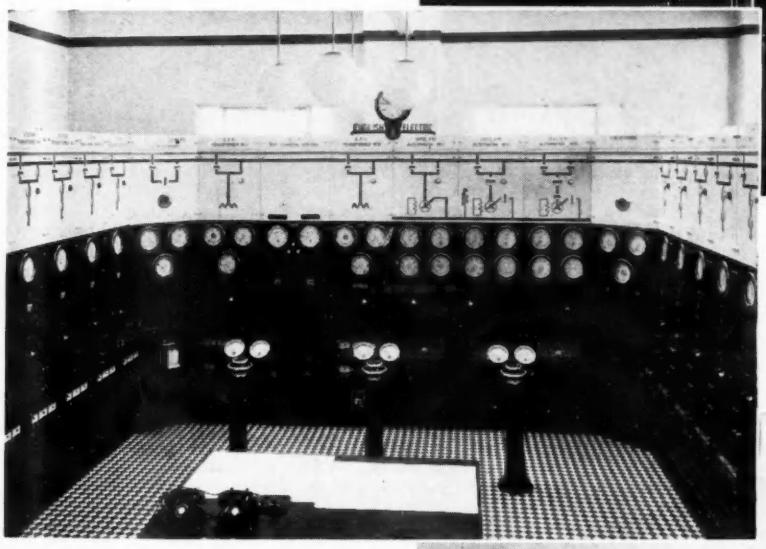
Increasing load necessitated additional supplies being made available for the works and industrial estate, and the Company opened negotiations with Birkenhead Corporation (which itself takes a bulk supply from the grid) and the Central Electricity Board on the basis of the Corporation's acquiring control of the station. The Central Board decided that the generating scheme in the area would best be served if the efficient 6,250-kW turbo-alternator were run from 7 a.m. to 10 p.m. at full load, leaving the balance of the company's electrical requirements during that period to be supplied from outside as well as the whole of the 6,000 kW taken at night and the 5,000 kW required during week ends at Port Sunlight. It was appreciated that a further levelling of the load curve of the grid in the district could be effected by running one of the 5,000-kW sets between 4.30 and 6.30 p.m. when the load of Lever Bros. reaches about 10,500 kW, thus reducing the energy imported during the peak to a nominal amount.

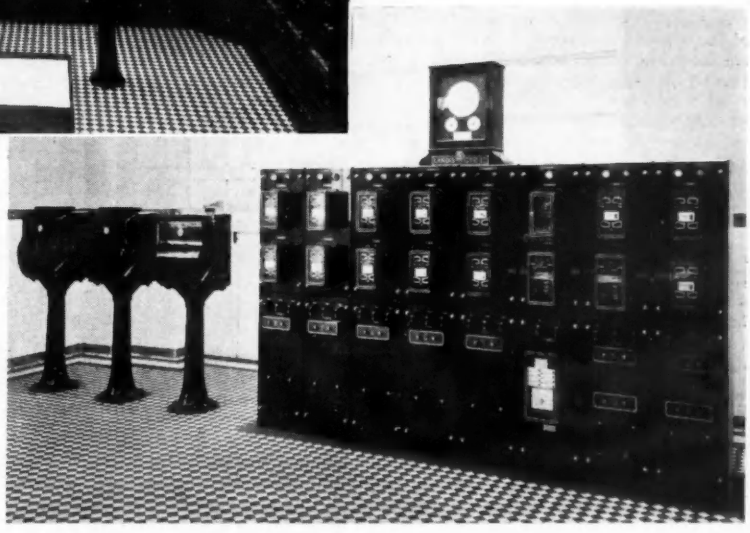
The Central Board therefore entered into an agreement with Birkenhead Corporation (as provided for in the 1935 Act) and the Corporation entered into an agreement with Lever Bros. to regulate the manner in which the station should be operated. This arrangement was carried into effect at the beginning of last August.

A connection has been made with the Central Board's system at Birkenhead, about 5½ miles away, by means of two 0.25 sq. in. 33-kV cables each connected, without switchgear, to the terminals of two 15,000 kVA Hackbridge transformers at Bromborough. These transformers are equipped with Fuller on-load tap-changing gear on the high-voltage side; cooling is natural up to two-thirds of their rating and by forced air above. The 33-kV windings are in delta and the 6.6-kV windings in star. Connected to the lower-voltage terminals of each transformer is an auxiliary transformer stepping down to 400 V.

Seventeen 6.6-kV ironclad switch units of the English Electric Co.'s manufacture, with de-ion arc suppression and a rupturing capacity of 350,000 kVA, have been installed on the ground floor under the control room, which leads out of the turbine room. These take the place of a cubicle type switchboard in the same room and the change-over was made piece-meal without interrupting the main supply. The new gear has been erected in two banks and is provided with double bus-bars and bus coupler switches. It controls the three generators as well as the two transformers and 6.6-kV feeders radiating to the various sub-stations.







Above: Grid sub-station showing two 15,000-kVA transformers with incoming 33-kV lines. Left: Main board in control room. Bottom: The metering board for grid supply, power station generators and auxiliary units. The three switches on the left are field suppression switches for the main generators

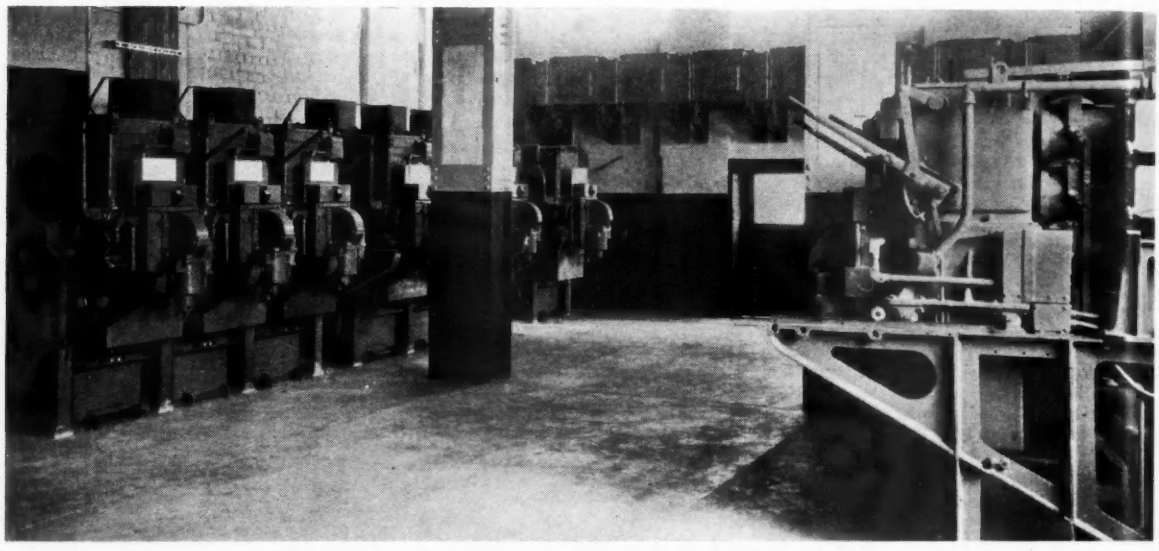
In laying out the connections, the need to eliminate the risk of fire spreading has been kept well to the fore. Behind the switchboard the cables, both power and control are run in trenches filled with sand. Both types of cable are armoured and the control cables take separate routes to the control room. An automatic CO_2 fire fighting equipment is being installed.

Outside the switchroom is housed the 50-V battery for operating the switches and providing emergency lighting. It is trickle charged through a valve rectifier from the a.c. station auxiliary supply.

The control room had also to be reconstructed without disturbance to the normal system of operation. The old panels were up against the wall on three sides so the new ones were constructed as an inner three-limb shell which leaves ample

space behind for inspecting the interior of the cubicles. The nineteen new panels correspond to the switch units with the addition of synchronising and tap-changing panels.

Facing the control board and in line with the three generator field-suppression switches beyond the operator's desk is an eight-panel summation metering board of the C.E.B. on which is integrated the registration of the transformer and generator meters, deducting that of the works transformer meter and adding those of the well-pump and service-pump meters. Round the walls of the control room will be hung diagrams of the internal wiring of the cubicle. Here again precautions have been taken against fire and no wiring is exposed; heat is provided by built-in electric fires.



Metal-clad 6.6-kV switchgear. On the back wall is shown the bus-bar trunking interconnecting the switchgear on each side of the switchroom, and containing "A" and "B" bus-bars

Electricity is distributed to sixteen sub-stations serving the company's various works and the industrial tenants and houses on the estate. The older works installations were on the 300-V d.c. three-wire system, but these are being gradually changed over to the standard 400-230-V three-phase four-wire system.

A typical example of domestic utilisation was found in one of the newer one-chimney houses rented at 14s. per week. This contains one large living room, with windows at each end, heated by a boiler-backed coal-fire over which a trivet can be swung for boiling a kettle. For warming the room electrically in the between seasons a plug socket is provided. Leading off the living room is the kitchen, which contains a cooker and a wash-boiler (from which hot water is obtainable when the fire is not in use). The washer is plugged into the cooker control switch unit.

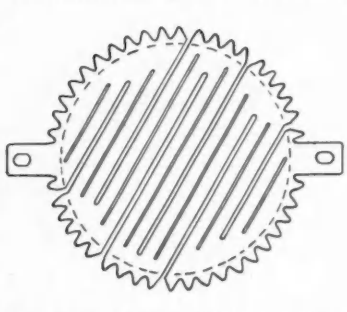
In two of the three bedrooms are 360-W tubular heaters underneath the windows, no fire-places being installed. Stair-case lighting and lamps over the beds are controlled from two points. One switch for each upstairs room is outside the door and there are no switches in the bath-room, which is illuminated from an insulated ceiling fitting.

The tariff is 12½ per cent. of the rateable value per annum and ½d. per kWh. Adding the rents of the cooker (5s. per quarter) and wash-boiler (2s. 6d.) the average overall cost of electricity works out at from 2s. 6d. to 3s. per week. The tenant expressed his entire satisfaction with his electrical arrangements, stating that he found it both convenient and economical.

Our thanks are due to Mr. R. E. Huffam, general works manager, and Mr. R. G. Devey, chief electrical engineer, for opportunities afforded us in obtaining the above information.

A New Danish Hot-plate

AN electric hot-plate designed to overcome the complaint sometimes brought against electricity of too slow heating has been developed by Laur. Knudsen, of Copenhagen. The greater part of the insulating material between the heating resistance and the cooking vessel has, by the use of low voltage, been entirely dispensed with.



The plate comprises a 0.019 in. thick disc which, by means of slits, is formed into a zigzag. As the bands so formed are rather wide there is a further slit in each. At each end of the zigzag a tongue is provided for the connection, while around the edge there is a deep scallop for fixing the resistance on to a dish-shaped base with a wide flange. The scallops on the resistance disc are bent around the flange so that the plate thus formed contains an air space. In order to prevent the resistance disc from sagging when a cooking vessel is put on it a series of supporting cross bars is arranged under the resistance material from which they are separated by a thin sheet of asbestos.

In order to avoid short-circuiting the resistance when a metal cooking vessel is placed on it the upper surface of the plate is coated with a heat-resisting oxide, which forms a sort of insulating enamel. The supporting bars below the resistance are also insulated in the same way, as is the edge of the dish-shaped metal base around which the edge of the resistance plate is bent.

Such plates are generally incorporated in cookers where it is possible to build in a transformer at the same time. Individual hot-plates can be built, in which case the transformer has to be arranged separately. The transformer steps down the normal mains pressure of 110 or 220 V to between 10 and 15 V.

The regulation of the heat of the plates is obtained by the use of a three point switch of special design which connects to taps on the secondary side of the transformer and thus permits a variation of the voltage. The switch is of the roller cam type, depressing spring contact fingers.

As the voltage is low there is little danger of arcs and the whole device complete is shockproof and can be made quite small.

The new hot-plates are obtainable in three sizes: 1 kW (5¾ in. diameter); 1½ kW (7 in. diameter); and 2½ kW (8¾ in. diameter).

The medium-sized plate is designed to be about the equivalent of an ordinary gas flame as regards speed of heating. No special cooking vessels need be used.

Cooker with new type of hot-plates and built-in transformer

Medium Voltage in Houses.

By T. C. Gilbert, A.M.I.E.E.

THE Electricity Supply Regulations, 1937, will permit an undertaking faced with voltage regulation difficulties to supply from more than one pair of terminals at low voltage any consumer whose installation is rated at more than 8 kW, including lamps (Clause 28). This figure has been drastically reduced from that considered necessary in the 1934 Regulations, which stood at 15 kW. The presence of medium voltage in possibly small buildings has exercised installation men very considerably in the past. It has rarely been felt that possibility of shock at medium voltage has been entirely eliminated, whatever the final arrangement decided upon. This problem is likely to become intensified in the future, as practically all installations which include a cooker will have a capacity in excess of 8 kW.

It is reasonable to assume that advantage will be taken of this loosening rather more in the rural area than in towns and cities. Voltage regulation presents few problems on modern urban networks, but the position is very different in the country, where supply is often by means of overhead line. Even small networks are subject to considerable voltage variations—probably within the permissible limit, but none the less causing considerable annoyance to the consumer—and most future supplies to country houses and farms will probably be given over the three phases.

Protection Against Shock

The problem of protection against shock is still awaiting solution as regards the rural consumer, and although the use of medium voltage does not increase the risk of shock to earth, yet a possibility of shock between phases is envisaged in later paragraphs of Clause 28. Under paragraph (b) (iii) the Commissioners require that, in any room containing different pairs of conductors, all socket outlets shall be connected to one and the same pair of conductors. This appears an easy get-out of the whole problem of protection against medium-voltage contact, but is at variance with I.E.E. Regulation 616, which permits the appearance of two phases in one room under certain conditions. The Regulations of 1937 go on to say, "provided that any consumer's installation which complies with the provisions of the Institution of Electrical Engineers Regulations shall be deemed to fulfil the requirements of paragraph (b) of this Regulation," which has just previously demanded something in excess of the I.E.E. Regulations.

Apart from the possibility of an amendment of this I.E.E. Regulation to bring it into line with the Regulations of 1937—which is understood to be likely—it will be obvious that the placing of wall sockets on more than one phase in any one room is simply asking for trouble sooner or later. At the present stage of electrical development such a risk should never be presented to any consumer, large or small; under the old 15-kW limit only the larger consumer was affected, with consequently better opportunities of removing phases farther apart, but the reduction to 8 kW brings the small consumer, with usually a smaller house, into the picture.

Can we accept, however, the Commissioners' simple remedy of placing all sockets on the same pair of conductors as providing a solution to the problem without considerably increasing installation costs? Let us consider the case of a small country consumer requiring a cooker rated at 5 kW, water or other heating equipment at 5 kW, and about 1 kW for lighting. He falls easily into the category of those permitted to be supplied from more than one pair of terminals, and probably three phases would be brought into the building.

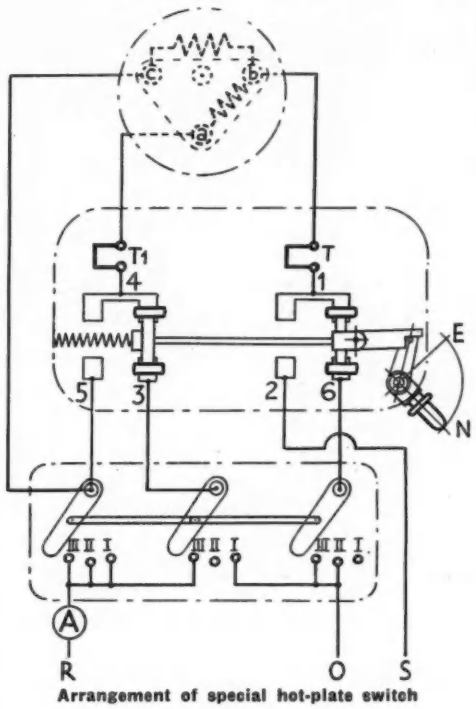
Supply authorities have several ways of dividing such a demand over the three phases. Some require more than one phase taken to the cooker (with a socket outlet on the control panel it is doubtful if this would comply with the present Regulations) while others simply place the different demands on to the three phases. For instance, the cooker is supplied from phase A, the heating demand from B, and lighting from C; at the next house the arrangement is reversed, giving some measure of rough-and-ready balance. This is probably the most common arrangement now employed.

The use of three-phase apparatus

With the cooker on phase A and the presence of a socket-outlet on the control panel, what is to happen if a further socket-outlet is required for an iron or a refrigerator in the same room? The new Regulations demand that these socket-outlets shall be on the same phase, but we want to confine phase B to heating or uses beyond cooking. If the second socket-outlet is extended from the cooker control panel we simply succeed in further loading up phase A, and no measure of balance is secured; voltage regulation is probably more important on this phase than on either of the others.

In other rooms, heating outlets are fed from phase B and lighting outlets from C; a solution could probably be found here by omitting all lighting outlets and using safety adaptors from the heating outlets for all lighting purposes. This is only feasible, however, if the consumer is taking a supply under a two-part tariff or all-in rate, and many consumers do not favour this arrangement in country districts, where the older buildings are large and roomy, making fixed charges on the heavy side as a rule. The flat rate seems to be especially favoured among farmers, owing to the lack of reasonable alternative methods of charge.

In small installations, therefore, it seems that we must divide the cooker, the heating load and the lighting load over the three phases, or, in the most favourable case, over two phases. This will lead to duplication of control gear, considerable increase in wiring costs, and possibly six meters may have to be installed, if anything approaching balance is to be secured in conjunction with the requirement that socket outlets in each room shall be on the same phase.



Arrangement of special hot-plate switch

Obtaining Balance

A less clumsy method of providing the requisite degree of balance over the phases without undue risk to the consumer is suggested below. It is already in operation abroad with a view to preserving reasonable voltage stability in the face of medium-heavy domestic demands. The suggestion is, in brief, that greater use should be made of three-phase supplies at power and similar points. There seems to be no reason why small domestic motors should not be three-phase instead of series wound as at present, resulting in an immediate improvement in reliability and cost.

During a recent visit to West Germany I noted that practically all the heavier demands were met from three-phase sockets in domestic premises. Vacuum cleaners, refrigerators, washing machines, and even gramophone motors were all three-phase, while heaters and cookers were similarly supplied. The German engineer maintains that safety for the consumer is no less than with single-phase supplies, the voltage to earth, which decides shock potential, remaining the same. There seems to be something to be said for this practice of isolating the three phases in one socket or one machine instead of our own method of using two or three phases for different purposes, and thus laying traps for the user in the event of fault.

Water heaters in the districts visited were almost all of the electrode type, lending themselves readily to three-phase operation. The larger cooking equipment was constructed in the same way, and as particular attention was paid to the rural installations in the area visited it was clear that these steps had been adopted with a view to stabilising voltage. Every farm visited had a three-phase supply, and this was utilised for even the smallest power demands.

At a convalescent home for boys in the middle of a pine forest at Stenern, near Wesel, the supply was by a long overhead line, and as electrical services were considerable in this building voltage regulation was very desirable. Two vegetable cookers were operated by means of three-phase electrodes immersed in water under the cookers, and very ingenious methods of control were employed in order to maintain water level and regulate current.

The three-phase supply was used with the ordinary cookers in this building as elsewhere, but the use of medium voltage

for the rapid heating of hot-plates normally operated at low voltage was new, and somewhat alarming, to me, and has never, as far as I know, been employed in this country.

Accelerated Heating

In addition to the usual heat-control switches, most cookers examined had a further switch, and this was known locally as the SH control. The Prometheus cooker in common use in the district had the additional switch at the side, apparently to prevent unintentional operation, for there seemed no reason why it could not be in line with the ordinary heat-control switches.

When this switch is operated, the hot-plate, which is normally supplied at 220 V, is placed across 380 V. On one cooker tested, maximum temperature was reached in 80 sec., and I was informed that this was the usual period. Automatic devices then substituted the 220-V for the higher voltage circuit, which went on with its work at 220 V.

In the diagram on page 357 R and S represent the phase lines and O the neutral. The hot-plate is fed normally with the switch at N, contact 1 being connected to 6 and contact 4 to 3. The working of the SH switch is unaffected by the setting of the heat-control switches at the bottom, but they must be at an "on" position.

When the switch is placed at E for accelerated heating, contact 1 is connected to 2, and contact 4 to 5; the thermal cut-outs T and T_1 are directly connected to the hot-plate, and operate in 80 sec. They effectively prevent the replacement of the switch when the hot-plate has reached a working temperature, ensuring that the device is only used for initial heating. When the thermal cut-outs open the switch the hotplate remains in operation in accordance with the position of the heat-control switches shown at the bottom of the diagram.

The ammeter shown in circuit is a popular form of current indicator on German cooker installations; sometimes the dial is illuminated in colour, and it indicates not only that the cooker is "on," but also to what extent.

Only one hot-plate on a cooker is operated by the rapid-heating switch. This plate seemed to be identical in details of construction with the other plates, with the exception of the underside attachment of the thermal devices, and that high- and low-current spirals are employed. The method of ordinary heat control is remarkably simple.

Regarding reliability, I was informed that the cooker examined had been in use for five years, and that only one hot-plate had been replaced. This, curiously enough, was not the plate subjected to what appeared to me extremely drastic treatment. I was also informed that in the R. W. E. area in West Germany the use of the rapid heating device was very extensive. It was also stated that 90 per cent. of new cookers incorporated this device.

The use of this device, or any similar improvement in cooker or heater control, can never be seriously contemplated in this country until the practice of using three-phase supplies is more general. The slow initial heating of hot-plates provides a considerable obstacle to the more rapid extension of electric cooking, and any means whereby this drawback can be overcome is well worth attention. As far as could be ascertained, the increased energy consumption over a given period with the use of the attachment described was very small, as would be expected with the shortening of the time required for initial heating of the plate, but one of the gravest causes for criticism was thereby removed.

Benefits of Three-phase Supply

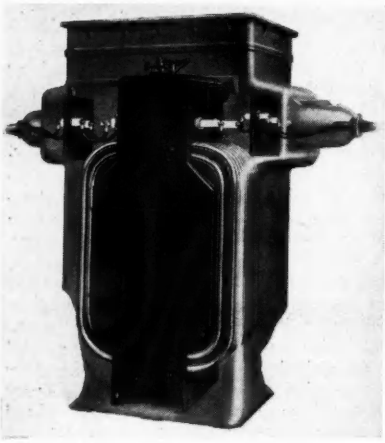
All the advantages appear to be with the use of the three phases as opposed to our present concentration upon one only. Domestic appliances fitted with three-phase motors would give better service than at present, while standardisation upon this simple type of motor should considerably reduce cost in view of the absence of expensive and cumbersome starting expedients. There is also a double star-delta system of three-phase six-element radiator control. Indeed, there is practically no form of domestic electrical service that cannot be readily arranged for efficient operation from three-phase supplies. Perfect balance over the available supply is ensured, and while wiring costs might be slightly increased to the individual point, they would almost certainly be reduced as regards the completed installation. Lighting, providing the smallest demand, could be left as at present, confined to one phase.

These remarks are intended to apply more particularly to the small domestic installation in which the total rating is in excess of 8 kW, and thereby liable to supply from more than one pair of terminals of a medium-voltage supply system, especially if situated in a rural area. It would appear that by no other means can considerable complication of the wiring lay-out be avoided, apart from the equally important aspect of safety for the consumer.

Shock risk should, on the whole, be considerably reduced. Appliances should be less liable to breakdown of insulation, in that this would require to be designed on a medium-voltage basis, and the greatest danger, that of shock to earth, would be correspondingly minimised. There would be little opportunity of shock between phases, unless the consumer was in the habit of taking his equipment to pieces himself, and in such cases even low voltage is dangerous.

Underground Sub-stations

IT is not always possible to find a site for a brick sub-station or sheet-steel kiosk near the centre of gravity of the load to be provided by a new housing estate. The difficulty can often be obviated by the use of a number of small underground transforming points teed from a high-voltage feeder or ring main, thus permitting the low-voltage network to be laid out in compact sections, capable of being operated in parallel if necessary. Improved voltage regulation, greater flexibility and a smaller area affected by an interruption in supply can be obtained in this way at small cost.

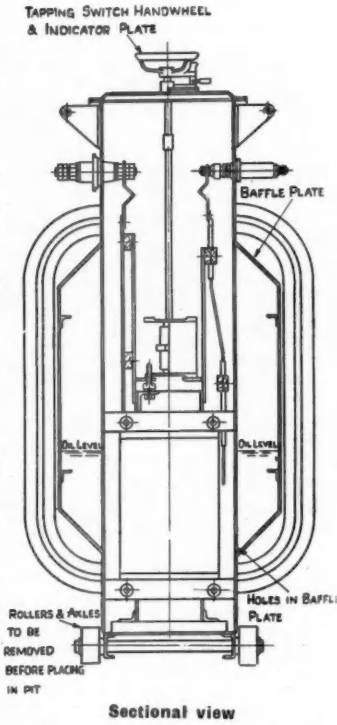


Ghost view of double tank transformer

For such a scheme the Hackbridge Electric Construction Co., Ltd., has produced a range of transformers for burying direct in the ground. Carbon tetrachloride fuse-isolators can be incorporated in the transformer equipment or installed in an adjacent manhole. Low-voltage cables are taken to a disconnecting box, from which the distributors radiate to network pillars.

A recent development of the company is a double-tank unit suitable for heavier loads. The outer shell is of cast iron, which is claimed to be non-porous and immune from oxidisation due to moisture in the soil, and is fitted with a water-tight manhole lid and with integral dividing boxes through which the high- and low-voltage cables are introduced. The latter are sealed by plumbed joints and terminated inside the case by porcelain insulators.

The transformer is inserted through the lid and connected to the cables by v.i.r. cable or copper rods. Breathing pockets on the tank sides, behind the cooling tubes, allow for expansion of oil. These are separated from the main tank by sheet-steel walls, which are pierced only at a level with the bottom of the pockets. Oil is put in when the transformer is hot, so that the dry air in the side pockets is at normal pressure when the maximum temperature is reached. An off-load tapping switch is provided for the high-voltage windings.


TAPPING SWITCH HANDWHEEL & INDICATOR PLATE
BAFFLE PLATE
OIL LEVEL
OIL LEVEL
HOLES IN BAFFLE PLATE
ROLLERS & AXLES TO BE REMOVED BEFORE PLACING IN PIT

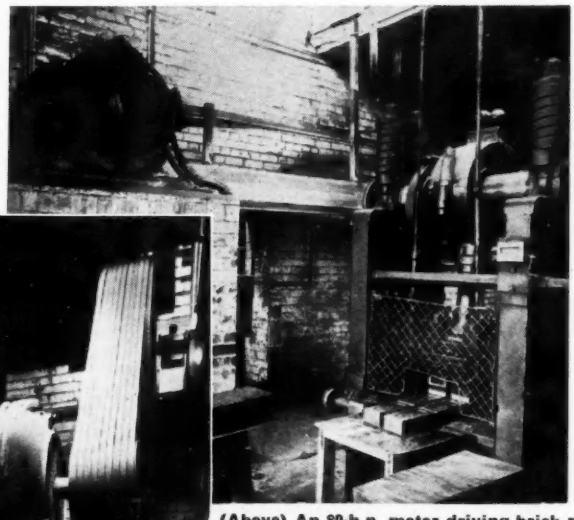
Sectional view

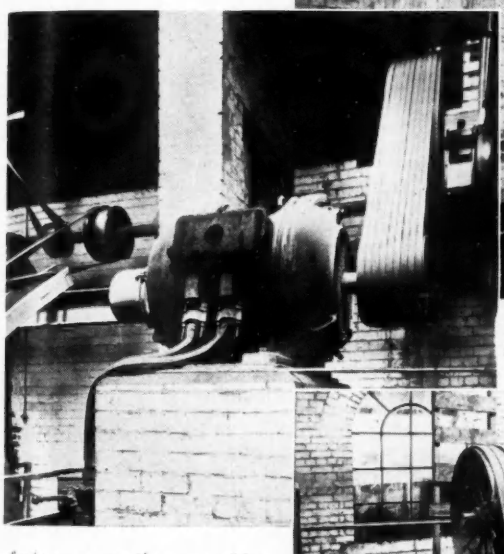
The double-tank type is built for maximum loadings of 200-kVA compared with the 150-kVA for which the company has for many years made transformers with the usual single ribbed tanks buried direct in the ground.

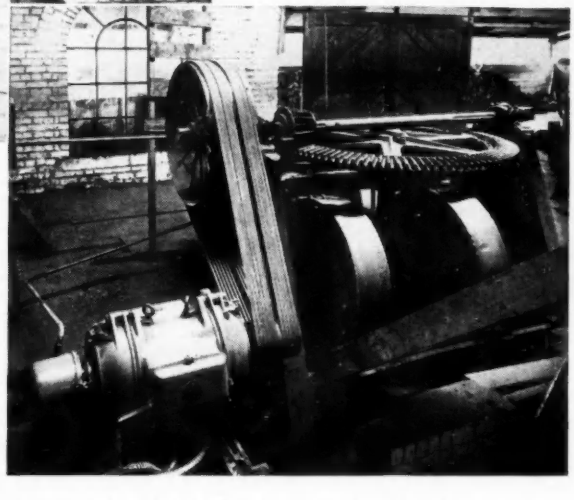
Large Brickworks Adopts Electric Drive

Conversion schemes in Wales

ONE of the most important brickyards in Great Britain is that of the Star Brick and Tile Co., Newport. Following the satisfactory results of recent electrification of allied companies' works at Caerleon, Risca, and Llantarnam, it has been decided to electrify the works at Newport, Alteryn, in Wales, and at Whitwick and Heather, in Leicestershire, and it is expected that the electrical apparatus will shortly be in operation at each of these places. The conversion to electric drive has been carried out by the British Thomson-Houston Co., Ltd., in collaboration with Mr. N. C. Richards, managing director of the Star Brick and Tile Co. Totally enclosed fan-cooled induction motors are installed in all dusty situations, a ventilated power-factor correction machine being situated in the substation. The ground floor of the building at Caerleon is divided into three bays, two of which are devoted to brick-making and the third to tile manufacture. Clay from the quarry is drawn up a ramp to the grinding pans in tall brick piers by means of an endless haulage system. A steady flow of raw material is maintained to feed four dry pans, and bucket elevators are installed to return waste and transfer the product to storage, from which it is fed directly to the mixers of the brick-making machines. For the manufacture of tiles a steel band conveyor supplies dry clay to a fifth pan, where it is ground wet before being removed by a rubber belt conveyor into maturing storage.







(Above) An 80-h.p. motor driving brick machines and mixers through a lineshaft; (left) a 100-h.p. motor, mounted on a brick pedestal, driving a lineshaft for tile machines; (below) a dry crusher pan driven by a 40-h.p. motor.

Formerly the Caerleon works was driven by a compound steam engine direct coupled to a main shaft running at 120 r.p.m. and extending the whole length of the main building. The various drives employed large and expensive belts which frequently broke or slipped when a jam occurred on a machine. Now the tripping of an overload relay brings the motor to rest without risk of damage.

With ordinary flat belts the speed ratio between driven and driving pulleys should not be greater than 5:1, and in order to obtain sufficient grip both pulleys must be large. At Caerleon Smith and Grace "Vulco V-Flat Drives" are used practically throughout the works, so that 725-r.p.m. motors can drive pulleys of the same diameter as those previously used.

The electrical installation was completed without interfering with production. The first stage in the change-over was the application to the mixing pans of totally enclosed fan-cooled slip-ring motors with oil-immersed starters, when the height of the working stage above floor level rendered it necessary to build a supporting structure for each motor.

As all the tile-making machines are situated in one bay group drive was adopted. A brick pedestal was built to locate the 100-h.p. motor as near as practicable to the existing lineshaft, which was severed during the week-end.

The change-over proceeded towards the steam engine so that the works would be in constant operation. The next stage was the electrification of three Bradley and Craven brick machines. At the rear of two of these there was insufficient space to accommodate the motors in a convenient position. The main driving shaft was again severed and retained, the motors being placed near the front of the building; they were coupled to the main shaft with flat belting.

The small bucket elevators were required to operate at a low speed, but the use of self-contained V-flat reduction units rendered gearing unnecessary, the existing flat belts being retained for the final drives.

The supply is obtained from the South Wales Electric Power Co. at 11 kV and transformed to 400 V, the cables being taken direct from the transformer to the bus-bars of a five-unit distribution panel. The loads are divided between four feeders, each feeder switch having an integrating watt-hour meter for checking the consumption of the various sections. Power-factor correction for the complete installation is obtained by means of a "No-Lag" asynchronous condenser, which is provided with a handwheel to vary the correction from zero upwards, adjustment being made to correspond to the load at any pediod.

At Llantarnam the steam engine previously used for driving the pipe machines and grinding pans has been replaced by a 200-h.p. "No-Lag" power-factor correction motor, while at Risca a motor of similar type and rating has supplanted an oil engine. At both works the conversion schemes were completed without interfering in any way with production.

Electrical Practice in Automobile Equipment

Although there have been a few exceptions to the rule, it has for many years been the usual practice to earth the negative side of the electrical system of motor vehicles. Now, however, there is to be a reversal of this practice, and it is gradually becoming the rule to earth the positive terminal of the battery. The change is not being made without good reasons, some of which, on the authority of Joseph Lucas, Ltd., are: (1) Less burning away of distributor electrodes owing to the distribution of the burning over the negative electrodes.

(2) Working conditions for ignition equipment are less strenuous. The sparking-plug voltage is dependent largely on the temperature of the negative electrode, the voltage falling as the electrode becomes hotter. In general, the central electrode of the plug is hotter than the earthed electrode, so that lower voltages will be obtained if the central electrode is negative.

(3) Less corrosion of battery terminals. In any electrolytic cell it is the anode or positive terminal which is attacked. Those responsible for the supervision of electrical adjustments and repairs in motor garages and service stations should remember the change that is taking place and differentiate between the newer and the older vehicles.

Meetings and Discussions

On Wednesday last the Wireless Section of the I.E.E. heard a paper on marine radio developments which showed that the use of radio-telephony is advancing and that valve sets are rapidly replacing spark equipment. Before the "Mechanicals" last week Mr. A. P. M. Fleming spoke on a subject on which he is an acknowledged authority—the selection and training of apprentices in the engineering industries. The magnificence of the illuminations in Paris for the International Exhibition which opens there in May was amply demonstrated by the details which Monsieur H. H. Maisonneuve presented at an architects' conference recently organised by E.L.M.A.

Ships' Wireless Equipment

MARINE radio progress is surveyed in a paper by Commander F. G. Loring (International Marine Radio Co.) and Messrs. W. L. McPherson and W. H. McAllister which was read before the Wireless Section of the INSTITUTION OF ELECTRICAL ENGINEERS in London on March 3rd.

The first part of the paper is a record of the state of the art obtaining in 1936, when the number of ships fitted with spark equipment had decreased from 86 to 63 per cent. in five years. Spark sets of over 300 W input have been prohibited by international agreement, so that equipment on 6,000 ships will have to be modified before 1940. Some 3,000 ships have spark sets of less than 300 W.

At the end of 1935 the number of vessels fitted with radio equipment was 14,813 (excluding warships); 8,418 had spark sets only, 3,471 had valve sets only, 856 had both spark and valve sets, 982 were fitted for both telegraphy and telephony and 988 for telephony only, while 5,163 were fitted with direction finders.

The great advantage of short-wave equipment to shipowners is the remarkable range obtainable with simple and inexpensive apparatus. In five years the number of ships using short-wave sets increased by 388 to 610 and the traffic reached 1.5 million paid words per annum. In six years 800 coasting and fishing vessels have adopted radio-telephony. They are mostly ships not compulsorily fitted (*i.e.*, of less than 1,600 tons gross). The 50-W sets used have a nominal range of 150 miles over sea, though this is often greatly exceeded in practice.

A large Atlantic passenger liner during a round trip may pass up to 15,000 words of paid telegraph traffic and up to 25 telephone calls; 23 ships (six British) are fitted for (land) subscribers' radio-telephony service and 2,151 such calls passed through the London terminal during 1936.

The second section of the paper deals with the types of radio equipment now customarily fitted in cargo and passenger vessels, while the last section describes in some detail the extensive equipment in the R.M.S. *Queen Mary*.

The authors understand that the Board of Trade is prepared to accept valve transmitters in lifeboat equipments as soon as it is satisfied that they can be made equally as robust and reliable as spark transmitters. The Board is also considering the application of radio-telephony in this connection and, in the case of the *Queen Mary*, has approved the experimental installation of a small radio-telephone transmitter in addition to the radio-telegraph equipment.

The direction finder, formerly operated by the wireless staff, is now coming to be regarded as an instrument for operation by the navigational staff. There is little to choose between the two types as regards accuracy. The rotating frame type is, perhaps, the more convenient to install and use as a bridge instrument. The Bellini-Tosi type, utilising two fixed frames at right angles, is simpler and less costly, while the position of its frame aerial can be independent of the position of the receiver. The associated shore beacon transmitters are under the jurisdiction of the lighthouse authorities, and in some cases are used both for d.f. and position finding. There are 100 such beacons in north Europe and 28 on the east and 57 on the west coasts of North America.

Site factors in ships militate very seriously against both operation and maintenance. A dominating requirement is the necessity for facilitating repairs under service conditions at sea; space is very restricted and anti-vibration mounting is essential. When it becomes necessary to install within the limits of beam and fore-and-aft dimensions a number of aerials which may be in use simultaneously, it is difficult to overcome the effects of unwanted coupling between the aerials themselves and between the aerials and stays, etc. They also introduce considerable difficulty in duplex working, a feature of increasing importance in the largest passenger liners (and also in naval vessels), rendering necessary the provision in the receiving systems of special "pre-selecting" circuits using components capable of withstanding considerable voltage. Since it is customary to run radio transmitters directly from the ship's mains, it is of importance that the regulation of the latter should be good.

The radio power plant of the R.M.S. *Queen Mary* consists of two 45-kW, 220-V, 50-cycle, three-phase a.c. motor-alternators operated from the ship's 220-V d.c. mains and remotely controlled from the transmitting room. Heavy traffic conditions have fully justified this elaborate installation. The results have shown that in spite of the difficulties peculiar to ship installations, by careful engineering a good approach can be made to the operating efficiency of a large land station, where normally the transmitting and receiving sites are some distance apart, and space is available for extensive aerial arrays.

Craftsmanship Training

A PAPER which was read in London on February 26th at the INSTITUTION OF MECHANICAL ENGINEERS, by Mr. A. P. M. Fleming, discusses the changes which have occurred during recent years in industrial organisation and workshop practice in relation to the problem of the recruitment and training of apprentices for craftsmanship.

The author lays stress on the conditions which obtain within the organisation of the Metropolitan-Vickers Electrical Co., Ltd., without presupposing, however, that those particular methods are necessarily appropriate to firms manufacturing quite different engineering products. Details are given of the workshop training provided, and, after an expression of opinion as to the limited suitability of National Certificate courses for a large proportion of apprentices, of the part which the works school plays in providing classroom instruction bearing more directly on the manual processes with which these apprentices are being called upon to deal. Finally, attention is given to the promotion to junior staff positions of apprentices who have equipped themselves with the requisite technical knowledge.

The author observes that systematic workshop training is a much more important factor than inherited manipulative skill in determining the efficiency of a craftsman. Consideration of the effects which the introduction of modern tools and machinery and superior technical processes have had on workshop practice, suggests the need during the training of trade apprentices for the development of a greater degree of adaptability and mechanical instinct than was perhaps necessary before these facilities existed. Alteration in the character of the work required of craftsmen and of the responsibilities devolving on foremen renders it impossible for these men to play the same part in the training of apprentices as in the past.

It seems desirable that in every firm, however small, it should be the duty of some responsible officer to undertake the work of selecting the apprentices and of organising an appropriate scheme of practical training. The form which this training might take, and the extent to which the German system of special apprentice workshops might be followed, will depend on the company's facilities and manufacturing requirements. The apprentices should be encouraged to attend part-time evening courses at technical schools, and wherever possible these courses should be supplemented by works instruction bearing more directly on the manual processes with which the boys are being called upon to deal. It is recognised that the "workshop" courses which are arranged at many technical schools and colleges provide an important contribution to the training of craftsmen, but parents realise that if their children do not follow the normal National Certificate courses, their chances of promotion to technical employment are obviously lessened. Increased attention ought to be given to the provision of facilities for physical training and to stimulating, to the point of active participation, the interest of apprentices in subjects of a cultural nature.

The question whether the conventional period of training, which in this country ends at 21, should be changed to a specific number of years, as in the German system, irrespective of the age of starting is a debatable one. Mr. Fleming is of the opinion that while a satisfactory knowledge of the technique of workshop processes can possibly be acquired in a highly organised four-year course, the youth of 18 years of age is not sufficiently ripe in general workshop experience to undertake the full responsibilities of craftsmanship. On the other hand, if for some reason the starting age is later, being deferred to, say, 17 or 18 years or more because of previous employment in a "blind alley" occupation, this shorter intensive period of training should be sufficient.

The provision of adequate facilities for the promotion of superior trade apprentices is an essential requirement for a

healthy industrial organisation, but in the Metropolitan-Vickers organisation it is not yet clear how best to maintain the appeal of craftsmanship as a life work and ensure adequate retention in the shops of the highest-grade workers.

Lighting on the Grand Scale

THE last of the architects' conferences on lighting organised by E.L.M.A. took place at the LIGHTING SERVICE BUREAU in London on February 17th, when Monsieur H. H. Maisonneuve described the plans made for lighting the International Exhibition of Arts and Technique which is to be opened in Paris on May 1st.

Forty-five nations are erecting their own buildings, while France will construct no fewer than 220. As regards general decoration, the site has been divided into three main areas, each entrusted to the care of eminent architects, namely, the left bank of the river to M. Granet, the right bank to Messrs. Expert and Maitre, avenues and gardens to Messrs. Dupré and Mialet, while the River Seine itself will be dealt with by Messrs. Beaudouin and Lods.

The Longchamps and Laos sub-stations will supply two-phase a.c. at 12,000 V through four feeders, each loaded at 5,000 kW. There will be more than a hundred step-down sub-stations rated at between 180 and 1,300 kW. The total length of underground protected feeders will be 72 miles, 41 high-voltage and 31 low-voltage, while over 2,000 sub-circuits will be necessary. About 45,000 kW will be available, as compared with the 18,000 kW used for the French Colonial Exhibition in 1931. Temporary stands will need 20,000 kW, the amusement fair 2,000 kW, permanent buildings 7,500 kW, general illumination 5,500 kW, fountains 4,500 kW, illumination of the River Seine 3,500 kW, and of the Eiffel Tower 2,000 kW.

A set of 800 projectors equipped with 1,000-W lamps will floodlight the Eiffel Tower structure and colour screens will provide for change of hue. A battery of fifty searchlights equipped with high-pressure mercury lamps will direct toward the sky luminous beams which (in combination with, or separate from, the lighting of the structure) will form linear designs. About 10 km. of luminous tubes will frame in outline the tower arches and lattice work, so that below at ground level the illumination intensity will reach 20 ft.-candles.

Trees on the esplanade and Quai d'Orsay will have their foliage illuminated in blue or yellow by either mercury or sodium lamps hidden among the branches. In the flower beds and grass plots there will be "formal" blooms made of luminous tubes. The streets and promenades will be lighted with decorative standards of the indirect type, equipped with incandescent lamps and vapour tubes.

The coloured lighting of façades in all three main areas of the Exhibition will be under unified control from a central station, as will also the indoor coloured lighting of glass and metal buildings.

In contrast to the spectacular illumination on the left bank, the opposite side of the river will be in a more dignified architectural setting. The new Trocadéro on the hill top facing the Eiffel Tower will have its façade illuminated by yellow sodium lamps, while the background of trees will be emphasised by light from mercury lamps. The buildings of foreign countries are to be erected in terraced gardens, together with a lagoon on two levels and fountains, which will absorb 1,500 kW for power and light. Incandescent lamp projectors with colour screens will illuminate some of these fountains, but others will be lighted in such a way as to create an impression that the mass of running water is itself luminous; no beams will disclose the source of light. For traffic purposes in the neighbourhood of the lagoon short standards will light the ground only.

On the River Seine there will be fireworks, smoke effects and luminous fountains operated by underwater equipment. While the pumps and projectors will operate on the surface at night, at other times they are to be deeply submerged so as not to interfere with river traffic. In this way 191 fountains will be operated, while others will have motor-driven pumps in waterproof caissons downstream near the Jena and Debilly bridges. They will be regulated by electrically controlled valves and each water effect is to be lighted by five different sets of underwater projectors and floodlamps, colour changes being effected from a single control board in the central "studio." In addition, five floating pontoons will provide smoke and other effects; each will be equipped with a battery of projectors and each will tow a string of small moving fireworks pontoons. The general scheme is to be supplemented by an arch of luminous beams from large searchlights trained toward the sky. The river pumping and lighting display will need 4,000 kW.

A Palace of Light is being erected by the Syndicate of Producers and Distributors of Energy, with the help of the Cie. Parisienne de Distribution d'Electricité and the Paris district generating station authorities. The smooth facade will be colour lighted by projectors, while inside there will be demonstration rooms and typical lighting installations for the home, office, industrial plants, schools, museums, stores, shop windows, streets and air travel. One room will be entirely reserved for the physiological side of luminescent, ultra-violet and infra-red radiations. A conservatory will show how artificial light can enhance the natural beauty of flowers.

Experimental lighting in the Place de la Concorde, Paris

Apart from the Exhibition proper the lighting of the Place de la Concorde is being improved. The gas lamps caused glare, especially in wet weather. They have been replaced by 30-metre standards all round the Place, at the top of which are luminaires, which (during the daytime) can be lowered by a telescopic system so as to be concealed behind the trees. Each source is composed of six identical and superimposed elements equipped with a 1,500-W incandescent lamp in a silvered prismatic glass reflector. The vertical and horizontal values at the centre of the Place are 0.6 and 1.2 ft.-candles respectively.

Other schemes are in hand and lamp manufacturers are also to undertake floodlighting demonstrations in the provinces and Northern Africa.

Transformer Tap-changing

FOR the first time a paper on the construction and applications of transformer on-load tap-changing gear (to which reference was made last week) was read at the INSTITUTION OF ELECTRICAL ENGINEERS in London on February 25th. The discussion was opened by Mr. Johnstone Wright, who recalled that the C.E.B. had been considered adventurous for specifying tap-changing gear for its grid transformers. Comparison of the tenders first received for different methods had indicated that tap-changing on the high-voltage side would cost less and occupy less space. Subsequent performance had justified the choice made at that time. The C.E.B had spent £4 million on transforming equipment and the tap-changing gear had saved £500,000. The most serious mechanical fault had been over-running of the gear; the most frequent electrical faults had been flashing of the switches, arcing across segments and tracking on the insulators. But maintenance had

not caused much concern, though it seemed to vary with the type of reactor employed; the air-gap type appeared to have the advantage.

Mr. A. G. Ellis said that troubles encountered had been of the minor "teething" variety; he had not experienced any major faults. The features described by the author as desirable had been incorporated in the largest and highest voltage gear. Transformers had been so constructed as to permit tap-changing gear to be fitted later if not required at the outset. Voltage range and number of tappings should be restricted as much as possible, otherwise designers' difficulties would be aggravated and the gear unnecessarily complicated. Mr. Ellis made a plea for more standardisation on the part of power engineers, remarking that the C.E.B. had adhered to its requirements.

That the time had come for the transference of generators from the secondary to the primary distribution system was the opinion of Mr. F. C. Winfield. Their retention on the medium-voltage system was costly, caused vicious conditions and prevented the limitation of current. Tap-changing alone had enabled the present method to be maintained. On long lightly loaded semi-rural lines tap-changing sufficed so far as cooker voltage regulation was concerned, but something more (capable of instantaneous change-over) was needed to minimise lamp flicker when neighbouring cookers were switched on. All tap-changing switches should be outside the transformer tank, and seizure of shafts coming out of oil tanks required attention.

Mr. E. T. Norris remarked that all types of gear described by the author could be proved satisfactory, but an outstanding feature was their complication. Extreme accessibility was stressed because they needed constant attention. In contrast to one of the control (not switch) circuits illustrated in the paper with nineteen contacts Mr. Norris suggested an alternative with two contacts and an induction disc motor.

Mr. A. T. Chadwick was disappointed that the author had not discriminated between systems of connection, or indicated any preference. A little constructive criticism would have been of more value than plain description of types available. Mr. C. Rayner pointed out that the fineness of tapping governed the degree of flicker produced. More tapping points meant a greater number of operations and therefore more maintenance. The slight gain obtainable by closer regulation was offset by greater wear and tear. Mr. G. L. F. Metz suggested that stored energy operating mechanisms might in some cases be harmful by causing the speed of break to be too high for arc suppression. Selector switches should certainly be in separate tanks.

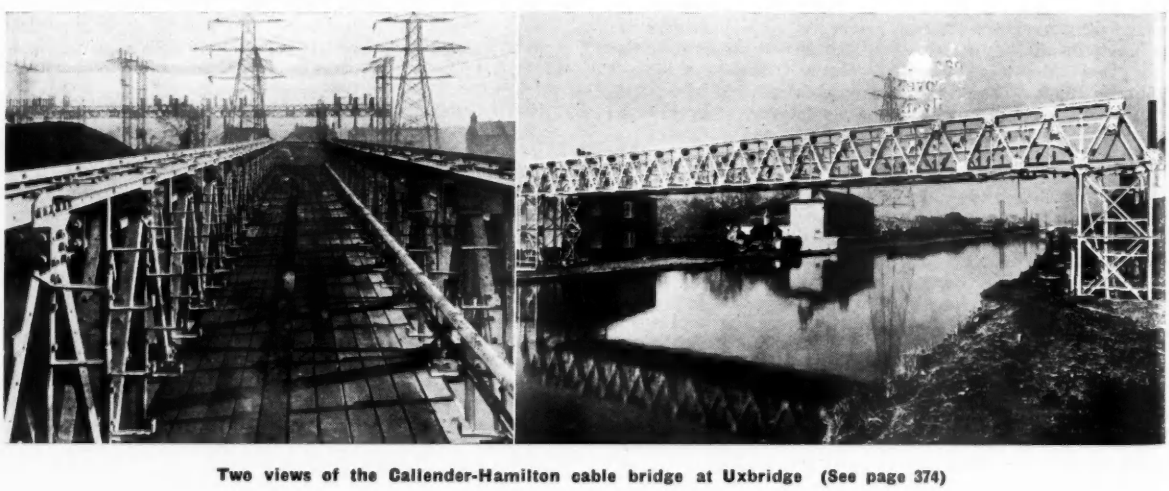
With regard to flicker Mr. C. C. Paterson explained that modern lamps tended to become less able to act as heat storage devices. But the heat storage type of cooker should help to avoid gulps of current at the ends of long lines. Mr. W. Goodman said he had recently inspected a small device with "wonderful" contact mechanism for voltage regulation on consumers' premises. Would it be advisable to employ such regulators in this country? Mr. G. G. Harris considered it very desirable to standardise the number and size of steps in voltage regulators, as suggested by Mr. L. Romero. Was there a voltage above which, or localities in which, impulse testing would become advisable for tap-changers? Should voltage regulators be shut off under short circuit conditions? Mr. S. J. Patmore, referring to parallel operation, said that mechanical coupling had been abandoned, but the balanced relay method with alarm devices did not meet the case of unattended plant.

Mr. H. Diggle, the author, in reply, considered that the C.E.B. had been wise to adopt tap-changing on the high-voltage side from the beginning. His own preference was for reactors with air gaps in the cores, rather than the closed magnetic circuit type. Standardisation of the number of taps was certainly needed. If systems were properly designed he did not see why users should have to specify differing requirements. Voltage regulation was either necessary or not; therefore it was not logical merely to allow so much per cent. of the transformer cost toward its achievement. The small regulator used on consumers' premises in Hungary was not widely employed. Its purpose was not so much to regulate voltage as to assist the distribution system. For example, if the line voltage were kept higher than it need be and reduced on consumers' premises, then the current to be conveyed by the feeder cables would be reduced. He strongly disagreed with advocates of integral gear; the tapping gear tanks should be separate and bolted on to the transformer, especially if they could not be maintained by skilled men. Safety measures were not required so much to guard against motor failure as against wrong connections. Mr. Norris' criticism was not fair, said the author, for surely he would not claim that large tap-changing gear could be controlled by an induction disc motor.

Rural Electrification.—At Hull on February 25th, Mr. G. V. Harrap read a paper before the NORTH MIDLANDS I.E.E. STUDENTS' SECTION entitled "Progress of Rural Electrification," which dealt with the financial sides of the Bedford, Norwich, and the Dumfries and Kirkcudbright undertakings, and contained a review of the general progress made toward profitable operation. The general details over the full years of working were analysed, to show the average revenue per kWh, average kWh per consumer, and average revenue per consumer. Reference was also made to the costs of supply to various classes of consumer, and the working costs, tariffs, and construction costs on all four schemes were dealt with. Forecasts were made of future progress and reference was made to the various problems encountered on these rural schemes. In the discussion, speakers referred to the MacGowan Report, and it was questioned whether rural schemes could be successfully operated without the help of a city undertaking. In his reply the author pointed out that many of the problems of rural electrification were economic rather than technical, and many speakers considered that more mechanical than electrical knowledge was required to obtain small industrial and farm loads.

Measuring Engine Vibration.—The measurement of vibrations in various parts of engines, and the comparison of stresses resulting therefrom under running conditions, form the subject of a paper by Messrs. L. J. Le Mesurier and R. Stansfield which was read at the NORTH-EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS at Newcastle-on-Tyne on February 26th. The authors have employed the Standard-Sunbury indicator (cathode-ray oscillograph) coupled through a valve amplifier to an electro-magnetic search unit placed close to the engine part being examined. Their experience in the research laboratory of the Anglo-Iranian Oil Co. is that this instrument facilitates the determination and analysis of deformations and stresses which cannot be calculated with any degree of accuracy or are extremely difficult to observe by other methods.

Electrodeposition.—An international conference, sponsored by the ELECTRODEPOSITORS' TECHNICAL SOCIETY, took place in London on March 3rd and 4th. Apart from social functions, the subjects discussed on the first day were practice abroad and the electrodeposition of base metals. On the second day the properties of deposits and precious metals deposition were dealt with. Nearly thirty papers were promised from Britain, France, the United States, Czechoslovakia, Russia, Holland, and Germany.



Two views of the Callender-Hamilton cable bridge at Uxbridge **(See page 374)**

Correspondence

Contributions from readers are welcomed. The writer should give his name and address, not necessarily for publication

Electricity Supply Finance

The conclusions arrived at by Mr. Ratcliffe in his letter which appeared in your issue of February 26th are based on an unsupported statement that a private generating plant operating on load factor of 20 per cent. can produce 600 kW of maximum demand and 1,050,000 kWh per annum, at a total cost (including capital) of £1,968, or 0.45d. per kWh. I would suggest that Mr. Ratcliffe should satisfy himself that these costs are obtainable in practice and then publish the details.

There is abundant evidence in the published statistics of the Electricity Commissioners to show that no public generating plant of a comparable size has ever been able to generate at so low a cost, and if all the public stations cannot do it, one doubts whether a private plant can. If this particular case were properly investigated and all the costs properly allocated, I venture to suggest that the average cost would be round about 0.8d. per kWh, at which price most large undertakings would be prepared to consider giving a supply under the conditions stated.

The reference to, and comparison with, the Central Board's tariff seem to me to be somewhat irrelevant. The advent of the Board has provided small undertakings with supplies at a lower cost than that at which they could generate their own requirements, and if a particular supply cannot be undertaken with an undertaking drawing its supplies from the Board, then it is quite certain the supply could not have been undertaken with independent generation, because the costs would have been higher. As this is the case, it seems to me to be unjust for the manager of an undertaking to imply that the Central Board's tariffs prevent him from obtaining load.

In his comparison, Mr. Ratcliffe assumes that the maximum demand of the consumer would always coincide with the maximum demand of his undertaking, which is to argue that diversity will not exist. It is well known that the simultaneous demand of an undertaking's consumers is very much less than the aggregate of the individual consumers' maximum demands; therefore, the standing charge should be reduced inversely to the diversity factor for the particular class of supply.

It appears to me that Mr. Ratcliffe's letter is based on erroneous data, and I feel sure "Accountant" will want the data put forward to be authenticated before starting any further analysis.

J. N. WAITE,
Hull, *March 1st.* *General Manager and Engineer.*

Too Many Technical Terms

Mr. Cosens's article on the above subject requires examination from a historical aspect before it is accepted. In his "Faraday as a Discoverer" (a book which every electrical man should know intimately) Tyndall tells us that the words anion, cation and ion are not much used and possibly then they would have been dropped without a feeling of loss, but we need them now! Doubtless 90 per cent. of electrical men have no more use for many electrical terms than people then had for ion, &c., but time may make a change.

Practical men don't have much use for the mho, but it is useful to the specialist. Mr. Cosens states that hydraulic engineers have no word for gallons per minute, but actually they are now using the "cusec" which, I believe, means cubic feet per second, so that this analogy fails. Even now we need the kelvin to replace the kilowatt-hour, or the overworked word "unit" which has about as many meanings as the word "line."

Mr. Cosen's remarks that Ohm's Law assumes constant resistance recalls a fierce controversy some years ago between Sir Richard Glazebrook and Silvanus P. Thompson. Glazebrook stated that Ohm's Law did not apply to a dielectric whose resistance varied enormously when current was passing through it, but Thompson asserted that Ohm's Law applied here as much as anywhere else. This is on all fours with permeability which varies with conditions, but I imagine that electrical men have become so accustomed to the idea of permeability that they mentally allow for its variability and would find it very troublesome to do without the word.

The pronunciation of many words is open to discussion. Is gauss pronounced like "gorse" or rhyming with "house"? Is the "o" in volt long or short? Should weber have English or German pronunciation? Most people pronounce joule as "jewel," but I recently heard a famous scientist pronounce it "jo-ull." On the other hand, the Germans pronounce watt at "vat." Probably it will be well for each nation to pronounce the words its own way provided that the spelling is fixed. As for the words leave them to time: the useful ones will survive and the others will disappear, but more terms will be needed in years to come than satisfy us to-day.

Tynemouth, *February 23rd.* C. TURNBULL.

May I, as a student recently entangled in the meshes of oersteds and magnetic permeability, express deep appreciation of Mr. C. R. Cosens's article advocating the simplification of our unitary system; and may I add to his suggestions that the ridiculous conception of the direction of flow of current used in textbooks be reversed? Nobody believes that the flow in a thermionic valve is from the anode to the cathode, yet in textbooks on electrolysis the current is said to flow in the reverse direction to that which is so obvious in these days of thermionic valves and cathode-ray tubes.

Also, cannot new terms, when not readily compounded from existing terms, be made with English bases?

Enfield, *February 23rd.* A. KENNEDY.

What is Ohm's Law?

In his article published in the ELECTRICAL REVIEW of January 29 (page 161), Mr. C. R. Cosens wrote: "R=V/I . . . is not Ohm's Law . . . it is merely the definition of what we mean by resistance. Ohm's Law states that, so defined, resistance is constant for any given conductor."

That statement is not correct. Ohm's Law is a law of the electric circuit, not a law of a particular class of conductors. Ohm's Law is true for any electric circuit, with the condition that the three values in the equation are (a) simultaneous, and (b) algebraic for the complete circuit. These two conditions take into account capacitance, inductance, galvanic and thermo-electric elements, and branching or "mesh" conformation of the complete circuit. The law in this general form is the formulation of Kirchoff's Laws of networks.

Expanded to the form V/I=impedance, it gives the corresponding relations for alternating current circuits, introducing the effects of frequency, or—more generally—rates of change of e.m.f. or current, whichever is taken as the independent variable. But R=V/I is true for the simultaneous instantaneous values in an a.c. circuit.

It is meaningless to say that a certain conductor or class of conductors "does not obey Ohm's Law." It is the relations of V, I, R, in any circuit which obey, or rather, which conform to, Ohm's Law.

Ohm's Law is still true for circuits containing conductors in which the resistance varies with the current. There are cases in which the resistance of a circuit varies with the e.m.f. imposed across some part of it. The extreme case is where insulation breaks down as when a flash-over occurs between terminals; in that case the circuit alters, but it is still true that the instantaneous values of V and I define the resistance of the altered circuit. H. M. SAYERS.

Beckenham, *March 1st.*

A National Testing Station?

The interlinking of power stations and the rapid increase in the number and size of generating units have all contributed to the urgency of making a really constructive effort to develop switchgear on fundamental principles more in keeping with present-day requirements. The general policy, however, appears to be one of putting off the evil day with regard to the scrapping of obsolete designs.

Certain fortunate groups of manufacturers, who have invested their resources in testing stations, can provide test certificates to their switches, whereas their less favoured competitors have to rely on the merits of the product itself without the aid of a "pedigree" accorded by a certificate. Are the latter, many of whom have a world-wide reputation for the quality of their products, to be exterminated or will they ultimately be forced through circumstances to combine, and with or without Government assistance, use their resources, which could be more usefully expended on progressive development, in providing similar test facilities? If so, and in view of the well-founded rumours of further testing stations, what will be the value of the various brands of certificates?

To sum up, the question is how soon can a station be set up under Government or N.P.L. control where both manufacturers and users alike will have facilities for obtaining independent data on their products or components. This is, in my opinion, absolutely necessary and as such certificates only would be recognised, why continue to multiply expensive plant, the cost of which must ultimately be borne by the user, unless with a view to research and progressive development?

Test conditions are not necessarily identical with those with

which the user has to contend, particularly if any device intended to function on a stated kVA fails to function on a lower kVA with the usual welding of contacts. Most inquiries from overseas particularly those relating to the best markets for British manufacturers are now restricting tenderers to those who can supply certificates. This is quite understandable in the case of the purchaser anxious to secure switchgear of a certain standard, but its effect on our export trade may be far-reaching, inasmuch as those manufacturers who have been steadily exporting products of a quality equal to that of the tested variety, but have no test facilities, will be debarred from those markets. If, as is probable, this business goes to our foreign competitors instead of becoming a plum for a few favoured British firms we tend to destroy our own export trade.

My purpose is to endeavour to call attention to the futility of our present policy, and also to the urgent necessity of concentrating on constructive effort as regards fundamental improvements in design, divorced to some extent from established practice where this is applicable only to the less onerous conditions of the past. G. E. WHITEHEAD.

Cardiff, *February 25th.*

Unsafe Switch Sockets

A recent experience with a switch socket permitting "overhang" causes me to view with alarm the wide use of such sockets. I refer to the type of switched socket outlet having side entry for the plug. Despite the prohibition of such sockets in Rule 1329 (b) of the I.E.E. Regulations, these are still being fixed in large numbers by responsible contractors and passed by supply authorities.

I am told that in the event of an accident those responsible for the installation of unsafe switch plugs can be successfully sued for damages, and I cannot help wondering whether contractors are aware of their legal position in this matter.

London, W.3, *February 22nd.* ALAN WILLIAMS, M.I.E.E.

Compulsion for Contractors

"Unregistered Competent" tells us in your issue of February 26th of a registered contractor who had grossly infringed the regulations and asks "Of what value is registration?" May I explain to your correspondent that the N.R.E.I.C. is still very young and in its embryo stage irregularities were bound to creep in. When the Register came into being it naturally did not have the necessary funds to employ inspectors, and acceptance of applicants was more or less in the hands of the local advisory committees.

The value of registration is just what bona fide electrical contractors like to make it, and I can assure "Unregistered Competent" that there is a day of reckoning at hand for all those who profess to be electrical contractors when they are not. There are now two fully qualified inspectors in the employ of the N.R.E.I.C. who examine applicants and also keep registered contractors "up to scratch," and I feel certain that if "Unregistered Competent" sends his facts along to the N.R.E.I.C. he will find that there is really something in registration. I would also suggest that he should send in his application for registration and help on the good work.

Glasgow, *February 27th.* ALEX MILNE, A.M.I.E.E.
Member of Scottish Advisory Committee, N.R.E.I.C.

The Contractors' Proposals

I should like to comment on the remarks of Miss Mabel Reading that a potential consumer prefers to be advised regarding proposed installation work by a supply authority. This is only natural, but I disagree with her when she says that the consumer will feel more satisfied that work carried out by the authority will be done in a thoroughly reliable manner.

As a contractor I should be ashamed to carry out an installation like some I have seen carried out by supply authorities. But then they have the pleasure of passing their own work, so what does it matter? A CONTRACTOR.

February 27th.

Testing Prepayment Meters

My interest has been aroused in the recent letters on the above subject, and I should like to make one or two observations. Regarding Mr. Rayner's method, as mentioned in your issue of February 19th, I agree with Mr. Bailey concerning the "snag" of the first meter switch opening and thus stopping the clock but the same thing occurs if any meter switch opens. The next point concerns the so-called "double-pole" switch which, as I read the diagram, is a "single-pole" switch.

Further, from Mr. Rayner's diagram the clock motor is in series with the meter synchronous motor, and I find that it is very unlikely that under these conditions the motors in clock and meter will operate. In short, I think Mr. Rayner's method complicated and unsatisfactory in comparison with the other methods put forward. S. A. DAINES.

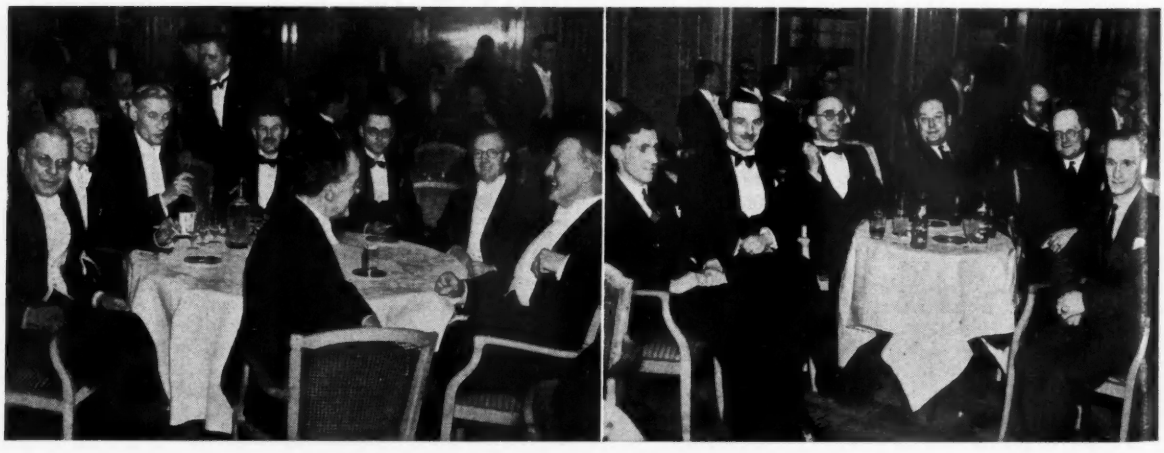
Bedford, *February 27th.*

The A.S.E.E. Dinner

NEARLY 420 members and guests of the Association of Supervising Electrical Engineers were received by the President, Mr. H. Hobson, at the Trocadero on Saturday last, easily the highest number yet recorded. The toast of "The Electrical Industry" was proposed by Mr. W. E. Highfield, who referred to quarrels within the industry as only enough to keep up friendliness and the ability to compromise.

Regarding compulsory registration, he doubted, from his knowledge of the experience of other important bodies, whether the Association's aim in this direction could be achieved for many years, although he thought that much more yet might be done on a voluntary basis.

The President, proposing the health of "Our Guests," referred to the Association as combining all that was best in trade unionism with the educational features of a technical institution. As a result of the efforts of its Council (Mr. J. Southern chairman) and its secretary (Mr. A. Brammer) its membership was continually expanding, and during the past year two new branches had been opened and six new local representatives had been appointed. Mr. G. Lathan, M.P. (president, National Federation of Professional Workers) responded.



Some of those present at the Supervisors' dinner [*Elec. Rev. photos.*

Left: Dr. A. P. Thurston and Messrs. J. R. Beard, H. Hobson (president), J. Southern (executive chairman), L. Bean, A. Brammer, G. Scott Ram, and J. M. Kennedy. Right: A Manchester group, including Messrs. H. S. Kelly, H. B. Mellor, P. L. Harrop, P. Maloney, A. Lea, and S. D. Clegg.

In responding, Mr. H. T. Young (president I.E.E.) emphasised the importance of our export trade, in the interests of which home buyers should exercise patience. While Great Britain occupied a leading position in heavy plant, cables and telephones, it was still the greatest importer of meters and instruments. Two-thirds of our buildings, he said, were inadequately equipped electrically. Better planning would provide cables to meet all requirements and the B.S.I. was about to introduce a specification, in line with that of other countries, standardising a flexible system of underfloor ducts. Every banquet hall should be supplied with conditioned air.

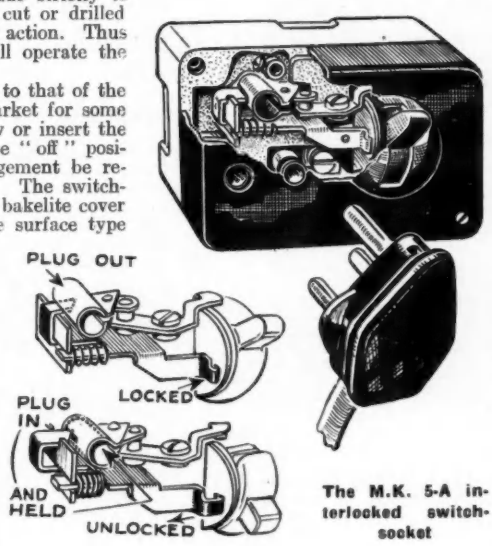
New Apparatus and Devices

for Domestic, Cooking and Heating, Lighting, Power and Scientific Purposes

Interlocking Switch Sockets

In a range of 5-A interlocking switch-sockets and plugs, introduced by M.K. ELECTRIC, LTD., Wakefield Street, London, N.18, the plugs and sockets are made strictly to B.S.S. 546, the earth pin not being cut or drilled in any way to work the interlocking action. Thus any standard 5-A three-pin plug will operate the switch.

The method of operation is similar to that of the 15-A size, which has been on the market for some time, it being impossible to withdraw or insert the plug until the switch is locked in the "off" position; neither can the locking arrangement be released until the plug is fully home. The switch-socket is mounted on a china base, a bakelite cover being provided. In the case of the surface type the base is recessed. In the sunk type the switch action and socket are integral with the front plate, which simplifies wiring and also makes the front plate self-aligning, irrespective of the position of the box in the wall; it may be sunk below the level of the plaster or surround. The plug tops are the latest type fitted with finger guards and an efficient cord grip.



The M.K. 5-A interlocked switch-socket

With the introduction of these new 5-A sockets M.K. Electric, Ltd., now offer a complete range of the 5- and 15-A sizes in surface bakelite and iron-clad types, and in the sunk pattern with bakelite and metal plates in all finishes, the whole range being available in double and single pole types.

Revo Switchgear Developments

Several new designs in switch- and fusegear for domestic use have recently been introduced by the REVO ELECTRIC CO., LTD., Tipton, Staffs. There is a shockproof combined switch and fuse, conforming with Home Office requirements and the I.E.E. Regulations. The base is of vitreous china and the hinged bakelite cover is interlocked with the switch action. It is substantially constructed and rated at 15 A for use with t.r.s. cable.

An iron-clad cooker control panel is another development by the company. The main switch incorporates a 30-A d.p. quick-make-and-break movement of positive action. All current-carrying parts are of high-conductivity bronze and copper and the moving parts can be replaced without dismantling the unit. A clear indicator shows the "on" and "off" positions, provision also being made for a pilot lamp. The secondary circuit comprises a three-pin 5- or 15-A anti-flash plug and socket controlled by a d.p. switch. This model has a screw-down cover, but others are available with hinged interlocked covers. Improvements have been made in model S. 9656, rated at 30 and 15 A, and complying with the I.E.E. Regulations and B.S.S. 438.

Built specially for the London County Council, the model S. 9102/5 iron-clad switchfuse and fuseboard will be found useful for flat-wiring installations; it is a typical example of the semi-standard productions by the company made to the rigid specifications of public authorities.

The fuseboard and switch-fuses are all neatly housed in a shallow yet substantial cast-iron case, and the rating of the main switches and fuses is 30 A at 250 V. The capacity of the distribution fuses is 15 A d.p., any number of ways between four and eight being obtainable.

The company's 500-V triple-pole distribution fuseboards have been redesigned and a new simple single-pole cooker control panel with a twin neutral connector and a flag indicator introduced for use with small cookers and water-heaters. The panel is unobtrusive and complies in all respects with the latest I.E.E. rules.

Radio Receivers

To supplement the extensive range of radio receivers already launched upon the market this season the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2, has just introduced four new types. One is a 6-valve superheterodyne for a.c. mains, the second a 5-valve model of the transportable type (for use on a.c. mains), the third is an all-wave battery operated receiver, and the fourth is an 8-valve all-wave superheterodyne for a.c. mains.

The "All-wave 6" receiver covers the following wave-bands: 13.6-30 metres, 29.4-81 metres, 200-550 metres and 950-2,200 metres, and is calibrated in station names, in metres and in megacycles. The "Transportable 5" is an entirely self-contained model and requires no more than a connection to the nearest mains point for its operation. The receiver has a built-in moving-coil speaker and frame aerial, and is housed in an attractive table pattern walnut cabinet with macassar inlay and chromium relief. A turntable is provided.

The "Fidelity" all-wave battery receiver has been designed expressly for overseas listeners, and the "Fidelity All-wave 8" receiver delivers an output of 6 W.

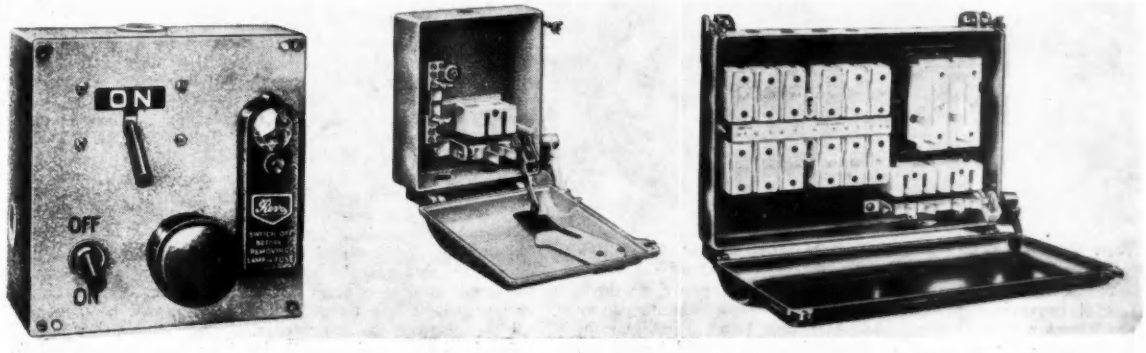
Flameproof Lighting Equipment

The latest development in flameproof lighting by GEORGE ELLISON, LTD., Perry Bar, Birmingham, 20, is a 100-W lantern which has passed the tests applied by H.M. Mines Department at Buxton to apparatus for use in atmospheres liable to become charged with methane, petroleum or acetone vapours.

The Ellison 100-W flameproof lantern fitted to a two-way assembly

It is very similar to the existing 60-W lantern for coal-mine lighting, but is larger and should prove useful for surface industries in addition to colliery work.

The new lantern can be bolted on to the same cable coupling as the 60-W lantern and may be connected to single-end or two-way or three-way assemblies. Two lanterns may be bolted to a straight-through coupling.

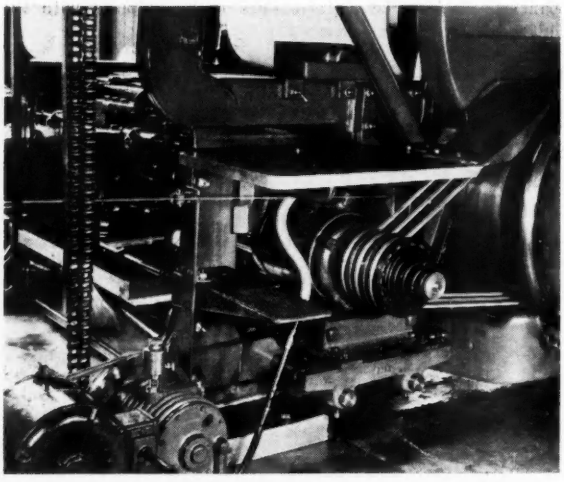


New Revo switchgear: A new cooker control unit rated at 30 A; a simple s.p. cooker control unit; and a specially designed combined switchfuse and fuseboard

D

Motor Speed Variation

The "Vee-Vee" speed varier manufactured by the GLASGOW ELECTRICAL ENGINEERING CO., LTD., 45-47, Pitt Street, Glasgow, is designed to give a constant-speed motor the characteristics of an infinitely variable-speed unit. It consists of one or more pairs of cones which intersect to form a V-shaped pulley carrying a standard V-belt. The velocity of the belt is varied by



Glasgow Electrical Engineering Co.'s speed varier in use

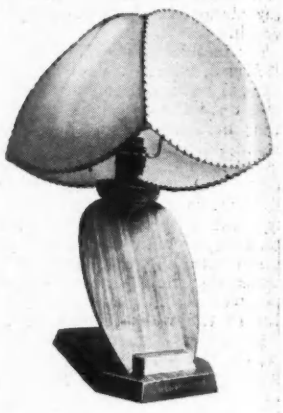
allowing the cones to expand or contract. The spring control of the belt tension reduces the stress transmitted to the driven machine at starting and acts as a slipping clutch on heavy overload.

Two models are made. The C.S. type is supplied where speed reduction as well as speed variation is required. Speed regulation is effected by a mechanical controller, which can be placed at a remote point. An inching device is also available. Maximum speed variation of two to one is obtainable, with a maximum reduction of six to one at low speed, *e.g.*, the countershaft speed might be any speed selected between 250 and 500 r.p.m. when the motor runs at 1,500 r.p.m. A modification of this type (C.S.S.) employs two countershafts in series to give a maximum speed variation of four to one, with a speed reduction up to twenty to one.

The second model, type F, is a compact self-contained unit for independent drive in which both driving and driven shafts are fixed, each being fitted with several pairs of cones. Speed variation is nearly double that of the C.S. type, but the horse-power transmitted is lower.

Television Relays in Buildings

The GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2, has announced that it has been carrying out experiments with a view to relay systems of television throughout a building being operated from one central receiver. It would be quite possible for a large hospital to have one screen in each ward operated from a central point, but it would be necessary to have a cathode-ray tube and loud speaker for each reception point and a special mains unit to supply the necessary voltage. The same arrangement can be adapted for use in large blocks of flats.



A novel Mallinson & Eckersley desk lamp. A clock can be fitted in the upright

The company states that it has already received inquiries from large blocks of luxury flats, and it is possible that in one new building, extensions will be provided in every flat from a central point.

More Coronation Equipment

PARTICULARS of special illumination equipment for the Coronation are still reaching us. The Metropolitan-Vickers Electrical Co., Ltd., Trafford Park, Manchester, states that in addition to the illuminated emblems of wood and metal already described in our February 5th issue (page 210) it is introducing a line of lower-priced devices executed mainly in weather-proof composition material. The items depicted are flags, shields, crowns, wreaths and the Royal monogram, either separately or combined. The lamp sockets fitted are weather-proof and will take any b.c. lamps, but for the best effect coloured sign-type and pigmy lamps are recommended.

Top: The R.E.A.L. "Jubilee" floodlight; below: A Simplex model and (right) new Metro-Vick designs

While intended primarily for Coronation illuminations three special low-priced floodlight projectors being introduced by the Simplex Electric Co., Ltd., Garrison Lane, Birmingham, are suitable for all types of floodlighting and will be offered as standard fittings in the company's usual range of floodlights. The "Minor," taking 60-100-W lamps, weighs 2 lb., while the "Junior" (for 150-200-W lamps) and the "Senior" (300-500-W lamps) weigh 2¾ lb. and 5 lb. respectively. They are available either with plain or coloured reflectors or with coloured fronts of red, green, blue or amber. Constructed of heavy-gauge rustless aluminium, with an unbreakable heat-proof and weatherproof reinforced front, the projectors are suitable both for indoor and outdoor use. Easy fixing and wiring have been catered for, and the steel body incorporates a cap which provides for easy focusing. Angular adjustment of the beam is attained by swivel stirrups.

The "Jubilee" floodlight, another low-priced model which proved popular for temporary installations during the Jubilee celebrations, has been completely redesigned by its makers, Rowlands Electrical Accessories, Ltd., R.E.A.L. Works, Hockley Hill, Birmingham. Four sizes are available, with diameters of 8 in. (for 100-W and 150-W lamps), 11 in. (200 W), and 14 in. (300-500 W). All models are fitted with unbreakable heat-resisting clear front covers, and (with the exception of the 100-W model) with adjustable ventilators, thus making them suitable for either upward or downward mounting. Although cheap these fittings are soundly constructed and are supplied complete with porcelain lampholders and earth terminal.

An illuminated buttonhole badge showing a coloured portrait of the King and Queen is a novelty marketed by the Ridgelite Electric Co., Ltd., 30, Islington Green, London, N.1. The "Litbadge," as it is called, is provided complete with lamp, flex and adaptor to fit any flash lamp or torch case.

For animating display pieces the C. & D. Co., 3a, Grosvenor Road, Chiswick, London, W.4, has a neat scintillator having a capacity of 1 kW at 200/250 V and suitable for either a.c. or d.c. It measures 5¼ in. by 3¾ in. by 2¾ in. and weighs approximately 4 lb. Ward & Goldstone, Ltd., Frederick Road, Manchester, 6, have sent us a sample of a new strip lighting lampholder, the stamped metal holding disc being shaped so as to render the connection between the cable and the holder watertight. For outside use the rubber inset prevents damp entering between the contacts. Strip lamp holders, wired to users' requirements, complete with lamps, can now be obtained on hire from British "National" Products, 173/175, Farringdon Road, London, E.C.1.

In response to a large number of inquiries the County of London Electric Supply Co., Ltd., and its associated companies in London, Surrey, Kent, Essex, Sussex, Hampshire and Dorset have provided an attractive coloured shield, showing the crown, the lion and the Union Jack, and surmounted by bunting; this may be purchased at cost price by consumers for the decoration of their houses, shops, &c. The shield, which can be adequately lighted by one lamp, will be obtainable at all the companies' showrooms. The companies have also offered all the local councils in their areas free electricity for exterior illuminations from May 10th until June 12th.

United States Electrical Exports

Increases to British countries

THE Department of Commerce at Washington has just issued the annual returns for 1935 of the foreign trade of the country, giving full details of the countries of destination of the principal products or groups of products. From these returns the following statement has been compiled. It will be seen that progress was made in virtually all the principal lines, receiving valves and commercial refrigerators being the only exceptions worth mentioning. There were substantial increases in shipments to British countries, as the following figures show:—United Kingdom, $6,937,000 as compared with $5,335,000 in 1934; Canada, $8,580,000 ($7,753,000); India, $2,632,000 ($1,956,000); Australia, $2,571,000 ($2,188,000); New Zealand, $1,318,000 ($1,070,000), and South Africa, $5,641,000 ($5,279,000).

The grand total of exports of American electrical machinery and apparatus in 1935 was $76,088,000 as compared with $66,525,000 in 1934. For 1936 the final figures are not yet available, but the total is expected to be over $90,500,000.

	1935 $ (000).	Inc. or dec. $ (000).
Generators, d.c.—		
Total	162	+ 76
To Canada	22	+ 14
„ Mexico	25	— 16
„ Colombia	18	+ 18
Generators, a.c., under 2,000 kVA—		
Total	274	+ 130
To China	29	+ 22
„ Mexico	55	+ 44
„ Brazil	35	+ 31
Generators, a.c., 2,000 kVA and over—		
Total	328	+ 61
To Spain	111	+ 68
„ Peru	45	+ 45
„ Brazil	140	+ 140
Steam turbine generator sets—		
Total	259	+ 92
To Argentina	15	+ 10
„ Venezuela	146	+ 126
„ Netherlands India	55	+ 54
„ Mexico	12	— 26
Accessories and parts for generators—		
Total	318	— 89
To Canada	53	+ 17
„ Argentina	43	— 7
Arc welding sets—		
Total	503	+ 127
To Mexico	51	+ 14
„ United Kingdom	56	+ 28
„ Canada	52	— 6
„ Brazil	41	+ 11
„ Soviet Russia	43	+ 43
Self-contained lighting outfits—		
Total	285	+ 76
To China	15	— 1
„ Canada	17	+ 3
„ United Kingdom	15	— 4
„ Mexico	23	+ 11
„ Soviet Russia	18	+ 18
Batteries, 6 and 12 v. storage—		
Total	1,111	+ 9
To South Africa	164	+ 38
„ Holland	71	— 11
„ India	98	— 30
„ Colombia	37	+ 4
„ Chile	39	— 2
Other storage batteries—		
Total	543	+ 56
To Mexico	90	+ 48
„ South Africa	121	+ 29
„ Chile	52	— 30
„ Canada	68	+ 16
No. 6 dry-cell batteries—		
Total	237	— 11
To Argentina	48	+ 1
„ Newfoundland	22	—
„ China	41	— 14
Flashlight batteries—		
Total	1,962	+ 129
To Argentina	136	+ 19
„ Colombia	135	+ 24
„ India	660	+ 181
„ Malaya	272	— 35
„ Siam	131	+ 59
„ South Africa	122	+ 28
Radio B. & C. dry batteries—		
Total	343	+ 96
To Argentina	154	+ 51
„ South Africa	45	+ 18
Other wet and dry primary batteries—		
Total	111	+ 42
To Canada	17	+ 1
„ South Africa	26	+ 13
Power transformers, 500 kVA and over—		
Total	98	— 67
To Venezuela	22	— 4
„ Brazil	26	— 18
„ Spain	20	+ 20
Distribution transformers, less than 500 kVA—		
Total	357	+ 12
To Mexico	54	— 29
„ Colombia	64	+ 15
Instrument transformers—		
Total	149	+ 72
To South Africa	41	+ 24
„ Brazil	34	+ 24
Other transformers—		
Total	263	+ 75
To Canada	29	+ 3
„ Mexico	49	+ 10
„ South Africa	23	+ 9
Double current and motor generators, converters, etc.—		
Total	272	+ 116
To Peru	62	+ 57
„ Canada	38	+ 2
Switchboard panels, except telephone—		
Total	322	+ 42
To Mexico	73	+ 28
„ Brazil	38	+ 30
Power switches and circuit-breakers over 10 A—		
Total	954	+ 432
To Canada	174	+ 53
„ India	46	+ 27
„ Mexico	89	+ 26
„ South Africa	279	+ 187
„ Brazil	86	+ 61
Fuses—		
Total	123	+ 6
To Canada	12	— 1
„ Mexico	24	+ 5
Watt-hour and other measuring meters—		
Total	393	+ 155
To Mexico	47	+ 4
„ Brazil	37	+ 27
Indicating instruments—		
Total	517	+ 76
To United Kingdom	73	— 3
„ Italy	99	+ 46
„ Canada	78	— 1
Recording instruments—		
Total	256	+ 53
To United Kingdom	24	+ 16
„ Canada	22	— 4
„ Soviet Russia	38	+ 24
Other testing apparatus—		
Total	748	+ 144
To Canada	217	+ 53
„ Soviet Russia	38	— 29
„ Japan	31	— 3
„ France	47	+ 2
„ Australia	40	+ 20
Lightning arrestors, choke coils, etc.—		
Total	498	+ 153
To Spain	88	+ 46
„ India	42	+ 5
Motors, 1/3 h.p. and under—		
Total	540	+ 8
To United Kingdom	103	— 35
„ Australia	57	+ 14
„ Canada	120	+ 30
Motors, over 1/3 and under 1 h.p.—		
Total	209	+ 25
To United Kingdom	37	— 8
„ Argentina	25	+ 12
„ Canada	31	+ 7
Stationary motors, 1–200 h.p.—		
Total	1,016	+ 164
To Canada	75	+ 1
„ Mexico	167	— 8
„ Soviet Russia	51	+ 46
„ Colombia	67	+ 22
„ Venezuela	69	+ 15
Stationary motors, over 200 h.p.—		
Total	203	+ 132
To South Africa	54	+ 52
Railway motors—		
Total	76	— 25
To Brazil	11	+ 8
Electric locomotives, railway—		
Total	53	+ 36
Electric locomotives, mining and industrial—		
Total	346	— 18
To Canada	50	+ 6
„ South Africa	116	+ 46
Electric trucks—		
Total	155	+ 32
Starting and controlling equipment for railway and vehicle motors—		
Total	203	+ 61
To Spain	35	+ 33
„ Australia	23	+ 14
Ditto, for industrial motors—		
Total	823	+ 112
To Canada	247	+ 15
„ Mexico	83	+ 21
„ South Africa	59	+ 7
„ India	32	+ 19
Portable electric tools—		
Total	950	+ 242
To United Kingdom	237	+ 55
„ France	57	— 30
„ Australia	90	+ 42
„ Canada	94	+ 17
Accessories and parts for motors—		
Total	1,430	+ 433
To Canada	313	+ 56
„ United Kingdom	230	+ 114
Household refrigerators—		
Total	9,354	+ 1,174
To France	786	— 193
„ United Kingdom	897	+ 54
„ South Africa	1,528	— 27
„ Netherlands East Indies	258	+ 57
„ Argentina	190	+ 45
„ Brazil	691	— 49
„ India	227	+ 10
„ Mexico	308	+ 128
Commercial refrigerators—		
Total	1,076	+ 59
To United Kingdom	227	— 172
„ France	360	— 2
Electric fans—		
Total	359	+ 23
To Canada	42	— 10
„ United Kingdom	37	— 30
„ India	33	+ 6
Incandescent lamps for automobiles, flashlamps, etc.—		
Total	228	+ 8
To India	76	+ 3
„ South Africa	23	—
Other metal filament lamps—		
Total	740	+ 71
To Chile	51	— 9
„ Argentina	63	— 57
Other electric lamps—		
Total	94	+ 11
To Canada	27	— 12
Household washing machines—		
Total	554	+ 231
To Canada	119	+ 22
„ South Africa	40	— 5
„ Australia	84	+ 61
„ Holland	86	+ 63
Domestic vacuum cleaners—		
Total	334	+ 104
To United Kingdom	107	+ 69
Flat-irons—		
Total	179	+ 16
To Argentina	21	— 15
„ Mexico	43	+ 4
Cooking ranges—		
Total	269	+ 19
To South Africa	62	— 68
„ Mexico	85	+ 51
„ Colombia	44	+ 20
Electric furnaces, etc.—		
Total	398	+ 47
X-ray apparatus, etc.—		
Total	1,416	+ 391
To Canada	342	+ 54
„ Mexico	115	+ 50
„ Argentina	79	+ 35
Radio transmitting sets, tubes and parts—		
Total	1,578	+ 488
To Mexico	100	— 36
„ China	142	+ 5
„ Canada	97	+ 33
„ Colombia	224	+ 50
„ United Kingdom	124	+ 101
„ Norway	132	+ 132
Receiving valves—		
Total	2,882	— 327
To France	241	— 303
„ Canada	242	+ 95
„ Argentina	496	— 104
„ Australia	307	— 266
„ Belgium	428	+ 57
Receiving sets—		
Total	15,472	+ 134
To Belgium	119	— 159
„ France	491	— 181
„ Spain	1,064	— 1,036
„ United Kingdom	1,596	+ 306
„ Mexico	1,432	+ 420
„ Argentina	1,129	+ 890
„ Brazil	253	— 919
„ South Africa	1 538	— 412
„ New Zealand	356	— 126
Receiving set components—		
Total	4,574	+ 215
To Argentina	726	— 296
„ Canada	1,019	— 93
Loudspeakers—		
Total	459	+ 98
To Argentina	54	— 21
Other receiving set accessories—		
Total	489	— 9
To Argentina	36	+ 2
„ Australia	65	— 36
„ Canada	74	— 15
Telegraph apparatus—		
Total	180	— 64
To Canada	25	— 115
„ Soviet Russia	36	+ 7
Telephone instruments—		
Total	239	+ 64
To Brazil	53	+ 1
Other telephone equipment—		
Total	1,684	+ 640
To Canada	414	+ 50
„ Colombia	104	+ 11
„ Brazil	290	+ 213
„ China	136	+ 23
Starting, lighting and ignition equipment (except spark plugs)—		
Total	1,223	— 10
To Canada	264	+ 47
„ Belgium	105	+ 33
„ Japan	90	+ 35
Insulating material—		
Total	297	+ 26
Metal conduit and switchboxes—		
Total	540	+ 90
To Brazil	81	+ 21
„ Colombia	38	+ 4
„ Argentina	30	+ 16
„ Mexico	54	— 25
„ Canada	65	+ 11
Lighting switches, sockets, etc.—		
Total	813	— 75
To Mexico	70	+ 5
„ Canada	134	— 23
„ United Kingdom	210	— 52
Insulated iron or steel wire and cable—		
Total	28	+ 4
Rubber-covered copper wire—		
Total	830	+ 188
Telephone cable—		
Total	59	+ 24
Insulated copper weatherproof wire—		
Total	251	+ 15
Other insulated copper wire—		
Total	777	+ 26
Nickel-chrome, etc., resistance wire—		
Total	325	— 48

New Books

Outdoor High-voltage Switchgear. By R. W. TODD and W. H. THOMPSON. Pp. 436; figs. 259. London: Sir Isaac Pitman & Sons. Price 42s.

This book has been written by two Metropolitan-Vickers engineers who have been associated for many years with high-voltage switchgear design and is a comprehensive treatise full of practical information.

The term "high voltage" in the title is used for voltages of 33 kV and greater, and while the book deals mainly with outdoor switchgear a chapter is devoted to the metal-clad type suitable for indoor installation. Some idea of the scope of the book can be obtained from the following chapter headings:—Station Layouts, Pedestal Insulators, Air-break Switches, Contact Pressure, Arc Interruption Phenomena, Re-striking Voltage, Oil Circuit-breaker Design, Bushings, Bus-bars, Fuses, Auxiliary Wiring, Metal-clad Switchgear, and Modern Circuit-breaker Design.

The subject matter is not confined to the switch itself, as chapters are also given on related matters such as porcelain manufacture, lightning-surge protection and protective gear. More information might well have been given on oil-treatment plant in view of its importance in large switching stations. The treatment of fundamental electrical phenomena is essentially sound and practical, although it is difficult to see why refraction of lines of force at the boundary of media of different dielectric constants should be referred to as "difraction." Many useful data are given regarding electrical characteristics of insulators and gaps, although, strangely, in the circumstances, the authors have drawn on American sources for much of this information. More complete information relating to long strings of suspension and tension insulators would be valuable.

The authors have made available in textbook form a mass of extremely useful information which could hitherto only be obtained by a laborious search through original papers and manufacturers' literature. The illustrations are excellent.

Connecting Induction Motors. By A. M. DUDLEY. (Third edition.) Pp. 464; figs. 408. London: McGraw Hill Publishing Co. Price 21s.

For the third edition of this useful book the type has been reset and new parts have been added. One of these additions is to show graphically the effect of chording by drawing the magnetic field for different coil-spans. This, of course, can be done more readily in an analytical manner, but the flux diagrams have the advantage of demonstrating that in the main the distribution remains sinusoidal.

The section on wave windings might be improved. Practice here differs widely. Many designers avoid natural wave windings, either because they do not know how to divide them into six parts, or because they are not acquainted with a simple method of doing so. Consequently, the modified wave winding with a whole number of slots per pole is often preferred, despite its limitations. Wave windings have been studied more thoroughly in this country than in the United States, and if the methods published years ago in the I.E.E. *Journal* were followed the flexibility obtained with the natural wave winding would not be so lightly sacrificed. We think that it would be an improvement to give winding instructions in tabular form suitable for use in the shops.

The author does not confine himself to mere practical data; much of his discussion relates to actual windings, apart from their connections. This increases the usefulness of the book, but it scarcely justifies the inclusion of certain diagrams and photographs of little practical value.

Many very useful matters are considered, such as the possibility of connecting a winding for more than one voltage, the effect of changing both voltage and number of phases, the effect of frequency, the possibility of varying the number of poles, location of faults, correction of magnetic out-of-balance, and so on. Doubtless some of these matters will decrease in importance as time goes on, for even under frequency-standardisation schemes many motors have been replaced and are rebuilt.

Television—A Guide for the Amateur. By S. A. MOSELEY and H. McKAY. Pp. 144; figs. 50. London: Oxford University Press. Price 5s.

In this book is given an explanation of the theory directly underlying a number of television systems, including some of the simple arrangements first devised and also many of the intricate equipments which at the present time give promise of successful futures. Practical applications are described without using highly technical expressions, and all are intelligible to the general reader with but moderate scientific knowledge. The description of the working of the Kerr cell is most lucid, despite the difficulties of the subject. The diagrams are helpful, but several are somewhat elementary.

The book guides its readers around many technical pitfalls and past intriguing devices with severe practical limitations. It should serve to point to the conclusion that the field has widened to disclose numberless avenues of approach to large-screen projection and numerous methods awaiting research and practical development. The book may encourage the man with a natural gift of inventive genius and stimulate him to work of vast scope and world-wide appeal; yet it must as surely bid him ponder upon the immense progress made in television in a single decade, while still leaving a very long way to go. It also conveys an incentive by its clear indication that the discovery of some means of overcoming present-day limitations may well be evolved at no distant date and by setting out precisely what those practical limitations still are. In juxtaposition with all this, the many photographs plainly depict the complicated nature and vast collection of apparatus that now comprises the latest developments in television equipment, or "plant" as it may now be aptly termed.

If the book is read carefully, however, and more than once, then much that is difficult to grasp will be made clear.

New Anglo-Canadian Trade Agreement

THE Anglo-Canadian Trade Agreement of February 23rd, which replaces that concluded at Ottawa, contains a number of concessions on United Kingdom electrical goods. The Dominion Government undertakes that the new rates of duty imposed, or the freedom of entry granted, as the case may be, shall not be changed except after an inquiry at which United Kingdom producers shall enjoy full rights of audience. The latter part of this undertaking replaces that in the old agreement which provided for reference to the Tariff Board and entailed discussion of what was a "reasonable" basis of competition.

The new agreement also consolidates certain margins of preference to be enjoyed by British goods over similar foreign goods. Schedule IV of the agreement contains a list of the goods which shall not be subjected to Customs duties higher than those specified therein. The electrical goods included in this schedule, together with the maximum rates (or treatment) therein specified, are as follows: Vacuum cleaners and attachments, 5 per cent.; magnetos and complete parts, when imported by manufacturers of internal-combustion engines, for use exclusively in the manufacture of such internal-combustion engines, in their own factories, free; motor rail cars or units and parts, free; railless trolley buses and parts, free; commutator copper segments, commutator insulating end rings, distributor rotors, wiring terminals, sockets, fittings and connectors, if of a kind or class not made in Canada, when for use in the manufacture of certain motor vehicles, free; ammeters, instrument board lamps, if of a kind or class not made in Canada, when for use in the manufacture of certain motor vehicles, free; electric telegraph apparatus and complete parts thereof, free; electric telephone apparatus and complete parts thereof, free; radio apparatus and complete parts thereof, free; dynamos or generators and transformers, n.o.p., 15 per cent.; motors and complete parts, n.o.p., 15 per cent.; certain electrical instruments and apparatus of precision of a class or kind not made in Canada and complete parts thereof, free; storage batteries, composed of plates measuring not less than 11 in. by 14 in. and not less than ¾ in. in thickness, and complete parts thereof, free; flameproof electric switchgear, for use underground in coal mines, and complete parts thereof, free; steam turbo-generator sets, 700 h.p. and greater, of a class or kind not made in Canada, and complete parts thereof, free; electric welding apparatus, not including motors, 10 per cent.; insulating pressboard, not less than 0.040 in. in thickness, free; hollow-ware, of iron and steel, coated with vitreous enamel, 17½ per cent.

In the foregoing list many articles to which freedom of entry is now "consolidated" were already on the free list; others, *e.g.*, trolley buses, instruments and apparatus of precision, and motor rail cars or units, were subject to 15 per cent. duty *ad valorem;* while on dynamos, motors and transformers, n.o.p., the reduction is from 25 per cent. to 15 per cent. *ad valorem*; on electric welding apparatus (not including electric motors) the reduction is from 15 per cent. to 10 per cent.

A few items of interest to the United Kingdom electrical manufacturer are also contained in Schedule V which fixes the irreducible margin of preference. These goods, together with the minimum percentage of preference specified, include:—Electrical instruments and apparatus of precision of a class or kind not made in Canada, 15 per cent.; storage batteries, composed of plates measuring not less than 11 in. by 14 in. and not less than ¾ in. in thickness, and complete parts thereof, 25 per cent.; steam turbo-generator sets, 700 h.p. and greater, of a class or kind not made in Canada, and complete parts thereof, 20 per cent.

Another electrical item in the new Canadian Budget, but not in the Agreement, is electric dry shaving machines and complete parts thereof. On these there is no duty under either the British Preferential Tariff or the Intermediate Tariff, but under the General Tariff 10 per cent. *ad valorem* is levied. Yet another is X-ray apparatus which enters free if British but is subject to 10 per cent. *ad valorem* under the other schedules.

Business and Industrial Notes

The Week's News. Showrooms and Exhibitions. New Installations. Overseas Trade. Publicity Material. Trade Announcements. Prices of Materials. Liquidations and Bankruptcies.

Electrical Amalgamation

Two electrical manufacturing companies who have been well known in the trade for over thirty years are amalgamating. They are the Lancashire Dynamo & Crypto, Ltd., and the Foster Engineering Co., Ltd., of Apex Works, Wimbledon. The directors of the former company have entered into a provisional agreement for the acquisition of the shares of the latter. The two concerns will continue to operate as separate companies under their existing managements, but there will be close co-operation both on the selling and manufacturing sides of the business.

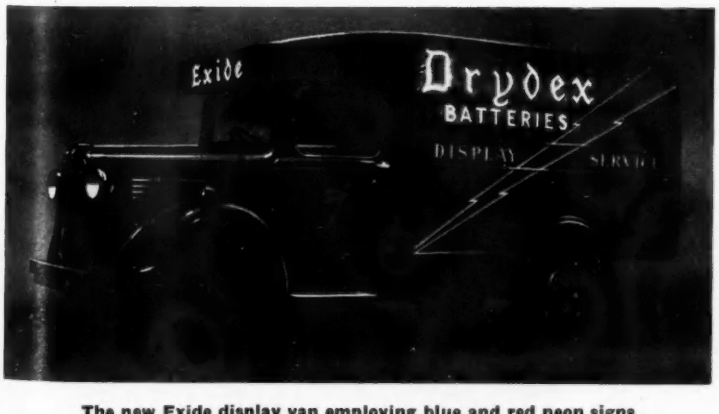
In a circular issued to shareholders last week the directors of the Lancashire Dynamo & Crypto announced a proposed increase of capital from £380,000 to £460,000 by the creation of 80,000 £1 ordinary shares. The general improvement in trade calls for expenditure upon extended premises and new machinery. The increased capital will meet the cost and provide for the repayment of outstanding debentures at the beginning of the year. The consideration for the purchase of shares of the Foster Engineering Co., transformer and switchgear manufacturers, will be partly by cash payment and partly by the exchange of ordinary shares in the Lancashire company for those in the Foster Company. For these purposes the directors will in the near future offer the present unissued capital and part of the additional capital now to be authorised to the ordinary shareholders upon terms not yet announced.

Wages in the Cable-making Industry

The Joint Industrial Council for the Electrical Cable-making Industry announces that the February 1st cost-of-living figure (51 per cent. above the 1914 level) will not involve any alteration in the wages of workers in the industry on the third pay day in March.

E.D.A. Luncheons

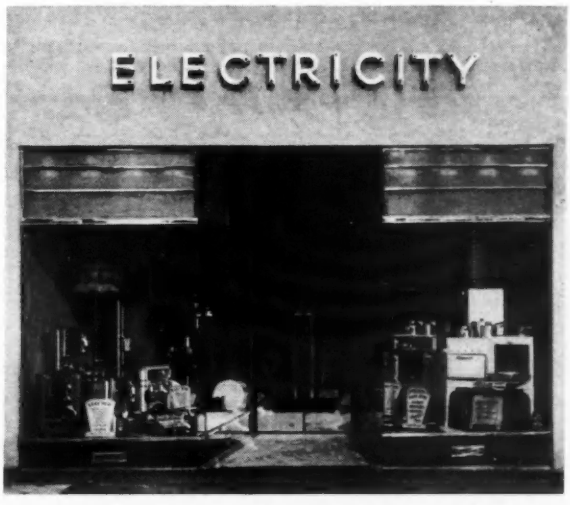
The annual luncheon of the South-West England and South Wales (Northern) Area of the British Electrical Development Association was held on February 24th at the Westgate Hotel, Newport. The toast of the Area Executive Committee was given by Sir Thomas Allen, who, *inter alia*, referred to the large number of tradesmen and dairymen who were using electric vehicles for delivery. Mr. C. D. Taite, chairman of the E.D.A. Council, in responding, reviewed the work of the Association during the past twelve months. The most important item, he said, was the training scheme whereby anyone employed in the electrical industry could take a course of instruction in electrical salesmanship. This scheme was not limited to employés of E.D.A. members only, so that young people employed by non-members were not handicapped. He said that co-operative advertising between electrical manufacturers and the E.D.A. had proved a success and sales of refrigerators had increased by 100 per cent. through this scheme. The E.D.A. was the largest promoter of exhibitions in the world. Of the electricity undertakings in the country 70 per cent. were members. Mr. A. Nichols Moore, chairman of the Area Executive Committee, also responded. He looked forward to the time when all undertakings would be members. Mr. L. Howles, proposing the toast of the guests and visitors, said that South Wales, although scheduled as a depressed area, was not so from an electrical standpoint. He referred to the large amount of electrical plant which was being put down in the district. Major I. C. Vincent, Mayor of Newport, responded. Mr. Nichols Moore presented the Area public speaking prizes, the winners being Mr. D. W. Bates, South Wales Electric Power Co. (first prize), and Mr. W. Rees, Cardiff Corporation Electricity Dept. (second). In the women's section Miss Sherwood, Newport Electricity Department, and Miss F. Tarr, General Electric Co., Ltd., Cardiff, took first prize and second prizes respectively.



The new Exide display van employing blue and red neon signs operated from a small generating set

New Showrooms at Shoeburyness

The fourth showroom of the Southend Corporation Electricity Department was opened on February 19th at Shoeburyness by the chairman of the Electricity Committee, Ald. S. F. Johnson, who stated that, since the inauguration of the Corporation's hiring schemes in 1931, 4,500 cookers, 10,600 water-heaters, 1,700 wash-boilers and 3,300 radiators had been installed in all parts of the borough. Arrangements had been made for cooking demonstrations to be given in the new showroom on one Friday in each month. He congratulated the engineer, Mr. A. C. Johnson, and his staff on their enterprise.



The new branch showrooms of the Southend Electricity Department at Shoeburyness

Exide Display Van

A new van which carries neon signs on the front and both sides has recently been put into service by the Chloride Electrical Storage Co., Ltd. In order to make the signs as effective by daylight as well as night the words "Exide Batteries" on one side and "Drydex Batteries" on the other side are made of stainless steel into which red neon tubes are recessed. The letters are 9 in. high with capitals 13 in. high. The frontal sign is of the one-sided box-type with "Exide" sandblasted into ¼ in. plate-glass; blue neon tubes are recessed into the back of the glass, outlining the name. A self-contained 1¼-h.p. Lister water-cooled petrol engine, with its own radiator and fan, is mounted behind the driver's seat. This engine drives an alternator with an output of 230 V a.c. 50 cycles; the power is stepped-up through a transformer to a working pressure of 12,000 V to 15,000 V, which ensures that the signs are as brilliant as the standard fixed neon signs on buildings.

Empire Exhibition, Scotland

The Empire Exhibition, which is to be held from May to October next year at Bellahouston Park, Glasgow, is being organised on the security of a guarantee fund which already amounts to over £600,000. The British Government has announced its decision to take part officially in the exhibition, and invitations to participate have been extended to the Governments of the Dominions, India and the Colonies. In addition to showing a representative selection of the foodstuffs and raw materials of the Empire and illustrating its potentialities, social, industrial and economic, the exhibition will display the latest developments in the industrial equipment of the Home Country. Inquiries for space should be sent to the general manager, Empire Exhibition, Scotland, 1938, 75, Bothwell Street, Glasgow, C.2.

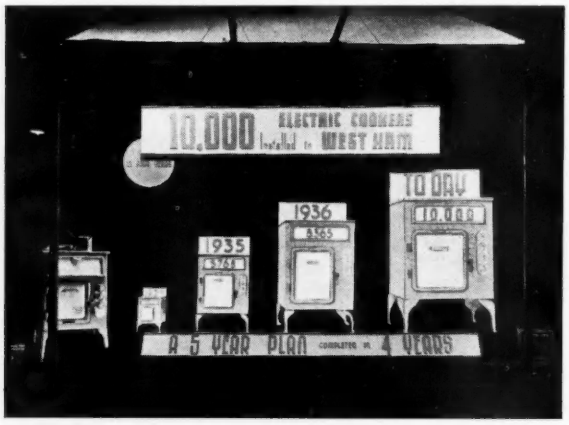
Small Discharge Lamps

Four or five months ago we reported that we had seen samples of a new lamp, produced as a result of research in the laboratories of members of the Electric Lamp Manufacturers'

Association, which represented a great advance in the lighting art. It was a discharge lamp with an envelope similar to that of the larger incandescent filament lamp but giving three or four times the light of the latter. We are now informed by the E.L.M.A. that this new type of lamp, in 80-W and 125-W sizes, is to be put on the market on April 1st. The small quartz discharge tubes are housed in pearl bulbs about the size of 150-W and 200-W filament lamps respectively for the two ratings. The new lamps are suitable for operation on the ordinary 230-V mains with a choke in series; they have three-pin caps which prevent their being plugged into the ordinary bayonet-type lampholder which would ruin them. The lamps have an efficiency from 3½ to 4 times that of filament lamps of the same rating and they have a life of about 1,500 hours. Because of the higher pressure at which they operate their light is whiter than that of the mercury-vapour discharge lamps of the larger sizes.

West Ham's 10,000th Cooker

The West Ham Corporation Electricity Department recently connected up its 10,000th electric cooker and advantage was



A cooker display by the West Ham Corporation Electricity Department

taken of the event to draw attention to the rapid growth in this section of the undertaking. A half-page advertisement appeared in the local Press showing by a graph how the demand for cookers has risen since 1934. The Department decided in 1933 to start a campaign to have 10,000 electric cookers installed in five years, and this objective has been attained in only four years. At the end of 1934, the number of cookers connected was 2,616, in 1935 there were 5,768, and last year the figure reached 8,365. Since 1933 the consumption of electricity for domestic purposes has increased by over 134 per cent. A window display was designed to link up with the local Press advertising which appeared simultaneously in all the Department's showroom windows.

Orders Recently Booked

Britannia Batteries, Ltd., has received from H.M. Office of Works a repeat order for a complete emergency lighting equipment, including a Britannia battery of 112 cells of 100 Ah with charging and automatic control gear to serve the North Block, King Edward Building and N.W. Quadrant of the British Museum. A similar battery and equipment were supplied by the company last year, and are in use for the emergency lighting in the West Building and Quadrant. During January orders were received from A. E. Morrison & Sons, Ltd., for thirty vehicle batteries, while an order has been received from Mr. J. W. Hughes, of Glasgow, for a battery of 130 cells for Muckairn Castle, Taynuilt.

Further large conversions to electric-discharge lighting are to be carried out in and around London. Siemens Electric Lamps and Supplies, Ltd., informs us that the Barking Corporation has accepted its tender for the supply and erection of 120 "Sieray" points in the Barking by-pass and River Road. Of these units 34 will carry two lanterns each. The East Ham Corporation has accepted the company's tender for 269 "Sieray" units for main-road lighting in the county borough, 126 to be erected on traction standards along trolley-bus routes and the remainder on new columns that are to be supplied with the other materials. The St. Pancras Council is proceeding with a scheme for improving the lighting of Euston Road, using electric-discharge lamps and equipment supplied by the same company.

Bull Motors informs us that included in the contracts secured since the beginning of the year are "Super Silent" motors for the *Daily Telegraph* building, Dagenham Town Hall, Municipal Hall, Wolverhampton, Liverpool University and Poplar Town Hall. In addition, "Super Silent" motors have been ordered for more than twenty new cinemas.

Prices of Materials

Messrs. Henry Gardner & Co. report, March 3rd: Copper bars (best selected), sheet and rod, £102, £5 decrease. English pig lead, £33 15s., £1 10s. increase. Spelter, £30 7s. 6d., £1 10s. increase. English block tin, £245, £5 10s. decrease.

Messrs. Frederick Smith & Co. report, March 3rd: Electrolytic copper bars, £73, £6 increase. Ditto, ditto, wire rods, £80, £16 increase. Ditto, ditto, h.c. wire, 10$\frac{15}{16}$d., 1¼d. increase. Silicium bronze wire, 11$\frac{7}{16}$d., 1¼d. increase.

Messrs. Edward Till and Co. report, March 3rd: India rubber, Para fine, 11¼d., ¼d. decrease.

South Wales Trading Estate

The South Wales and Monmouthshire Trading Estates, Ltd., has issued a booklet drawing attention to the industrial potentialities of the Treforest Trading Estate. This gives particulars of the low capital costs of establishing factories, the various services available, labour, transport and markets.

A Westinghouse Pocket Book

A handy morocco leather notebook containing data on electrical machines and apparatus, rules, formulæ, tables, and other miscellaneous information has been received from the Westinghouse Electric International Co. Space is also provided for personal memoranda and an extra memo refill is enclosed.

Electricity at a "Fun Fair" Exhibition

The second National Amusement Caterers, Showmen and Allied Trades' Exhibition was held last week at Dorland Hall, Regent Street, London. Among the exhibits was a small portable petrol-driven generating plant rated at 1,500 W; the output of the standard model is 110 V, but it can be made to generate at two independent voltages, 110 and 220, or converted for battery charging. Small motors from $\frac{1}{16}$ h.p., alternators, convertors, &c., were also shown on the stand of the Small Power Dynamo & Motor Co., Ltd. On the stand of Strand Automatics, Ltd., was a penny-in-the-slot shooting outfit; the gun is provided with a small focused lamp which operates target lamps controlled by photo-electric cells. A portable recording and reproduction gramophone was shown by Phono-Disc, Ltd., while microphone, amplifier and public address equipment was exhibited by Microphone Equipment, Ltd.; lighting and floodlighting equipment was shown by the Bell Electric Lamp Co., Ltd.

Science and Building

An exhibition of Science and Building, organised by the Department of Scientific and Industrial Research was opened at the Building Centre, 158, New Bond Street, London, on Monday by Mr. P. Thomas, President R.I.B.A. The exhibition comprises stands by the various Government departments and research associations—the Building Research Station, Forest Products Research Laboratory, Geological Survey and Museum, Fuel Research Station, Water Pollution Research Board, Iron and Steel Industrial Research Board, British Cast Iron Research Association, British Non-Ferrous Metals Research Association, Research Association of British Paint, Colour and Varnish Manufacturers and also of the British Rubber Manufacturers. The stand of the National Physical Laboratory included a portable photo-electric meter which has been designed to measure daylight factors in buildings of 0.03 to 2.5 per cent.

The Birmingham Showrooms

During the past few months the Birmingham Corporation Electric Supply Department has carried out extensive alterations to the interior of the city showrooms, 21, Paradise Street, Birmingham, in order to improve the layout and increase the facilities for the sale and demonstration of electrical appara-

The demonstration hall of the reconstructed showrooms of the Birmingham Electric Supply Department

tus, including provision for the payment of accounts. The most noticeable improvement effected has been the conversion of the octagonal room into a large demonstration room with ample modern seating accommodation and platform for use at the various demonstrations of electrical cookery and other domestic purposes.

Society of Irish Electrical Traders

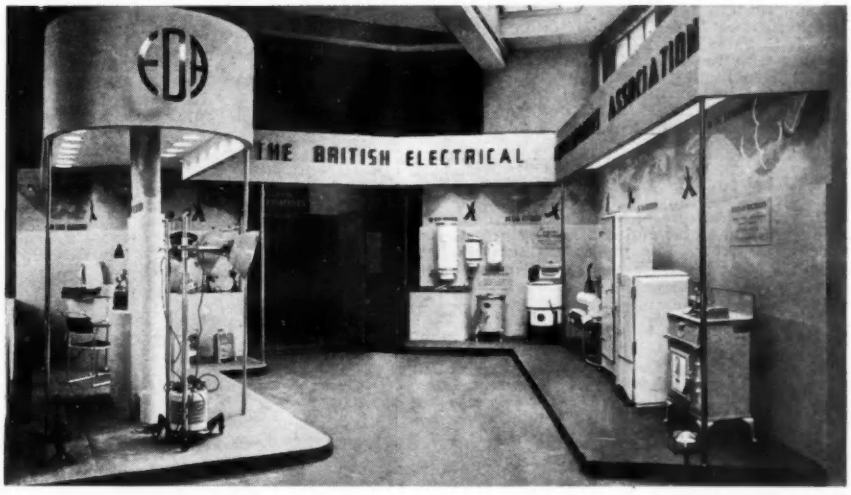
It was to be hoped that the Minister for Industry and Commerce would make use of the Society, representing, as it did,

the organised electrical industry in the Irish Free State, said Mr. A. G. Bruty (president) in his address at the annual general meeting of the Society of Irish Electrical Traders, held at Jury's Hotel, Dublin, recently. The year 1936 had been one of steady, useful work. The membership had increased and the financial position was sound. There remained a great deal of work to be done in connection with the question of terms, and a committee had been appointed to investigate the question of allied trade buyers, commercial users and special large buyers, and to fix discounts at which these classes could secure their requirements. A communication was sent to the Minister for Industry and Commerce offering the co-operation of the Society in any matters in which they could be of service to him. Some months ago representatives of the executive council visited Cork and interviewed Cork electrical traders, and a committee had been set up in Cork to deal with local affairs. During the year the representatives of the Society and of the Motor Traders' Society had met in conferences to consider difficulties existing in the granting of terms to the motor trade, and they hoped to secure a satisfactory solution on this matter. There had also been a conference with the director and chairman of the Electric Lamp Manufacturers' Association, but he was not in a position to report finality. A satisfactory arrangement, however, had been made with Solus Teoranta, and a representative of that firm had joined the executive council.

E.D.A. Activities

The principal electrical exhibit at the Hospitals, Nursing, Midwifery and Public Health Exhibition and Conference now being held at the New Horticultural Hall, Westminster, S.W., is the display by the British Electrical Development Association. The equipment on this stand illustrates the part which electricity plays in modern medical and nursing practice; it includes sun lamps and duotherapy units, electric blankets and heating pads, sterilisers, bronchitis kettles, &c., in addition to water heaters, washing machines, vacuum cleaners and other electrical aids to the comfort and efficiency of the sick-room, hospital and nursing home.

The latest use to which the "I'm Electric" figure of the British Electrical Development Association is being put is as a stainless-steel mascot on cars and vans. Particulars of this mascot are given in the Association's March programme, which also includes illustrations of a new series of local advertisements in which the "I'm Electric" figure is prominent. The suggested window display for the month has spring-cleaning as its keynote and makes a simple but effective display. Attention is also drawn to the National Electric Refrigeration Campaign, and to the material which the Association has available.



[Elec. Rev. photo.

The E.D.A. stand at the Hospitals, Nursing and Public Health Exhibition at the New Horticultural Hall

A Builders' Guide

The 1937 edition of "Laxton's and Lockwood's Builders' Price Book" has just been published (10s. 6d. post free). Apart from the prices given the book is of value to architects and contractors, as it contains particulars of the various sources of supply of material, &c. It is divided into different sections covering all branches of the building trade, and all items are listed in a comprehensive index.

Social Events

At the sixth annual dinner of the South Wales Electric Power Co., which took place at the Park Hotel, Pontypridd, on Saturday last, Mr. L. Howles, general manager, said that forthcoming expenditure included £400,000 for a 30,000-kW turbo-alternator, together with boilers and auxiliaries. During the past year the company had made considerable progress, the Upper Boat power station having been working to full capacity throughout the winter. That was partly due to the fact that a measure of prosperity was returning to the coal industry in South Wales. South Wales trading estate at Upper Boat was growing rapidly. There were many ways in which the company could help by giving facilities, and it was doing its best in that direction. He welcomed the general manager and staff of the Brynamman Electricity Supply Co., which was recently acquired by the South Wales Power Co. In the absence through illness of Mr. R. Roper (resident engineer at the Upper Boat station) the chair was taken by Mr. C. T. Allan (assistant manager).

In an amateur production it is, perhaps, unfair to single out individual performances, and in the case of the Clesco (County of London Electric Supply Co. and associated companies) Light Operatic and Dramatic Club which presented the musical comedy "To-night's the Night" at the Fortune Theatre on Thursday, Friday and Saturday last, it was not easy to do so. The play was produced under the direction of Mr. E. S. Rouse and to the music of Paul A. Rubens, the whole cast working well together. Those familiar with the plot of this amusing play will appreciate the special mention made of Clifford Thatcher, who so splendidly played the part of "Henry," Frank Shaw as the husband of "Mrs. Lovitt-Lovitt," well acted by Beatrice Shaw, and Leslie Gentry as "Alphonse," while we shall not soon forget the singing and dancing of Ivy Field ("June") and Maude Carter ("Victoria") and the performances of Maysie Covell, Frederick Green, Percy Gardner and Lawrence Adams.

On February 25th, 26th and 27th the Bruce Peebles Concert Party and Orchestra presented "Sparks and Flashes, 1937," at the Little Theatre, Edinburgh. The revue, which was attended by large and appreciative audiences, provided a number of spectacular events and while humour and harmony were the keynotes of the show, vocal entertainment was also provided. The show was produced by Mr. A. E. Crawley, and the works orchestra was conducted by Mr. H. Woods.

On Tuesday last the Telcon (Telegraph Construction and Maintenance Co., Ltd.) Social and Athletic Club held its second annual presentation concert at the works hall, Greenwich, when about 300 members and friends spent a pleasant evening under the chairmanship of Mr. C. J. C. Padfield, who presided. The proceedings took the form of a smoking concert, during which cups and prizes for cricket, billiards, shooting and other indoor sports were presented. Among those present were Sir Geoffrey Clarke (managing director of the company), Major H. Denison-Pender (director), Dr. E. W. Smith and Mr. L. J. Ransom (works manager). Sir Geoffrey, who presented the prizes, made a brief speech in which he referred to the relationship between employés and the directorate, who took a keen interest in the Club and wished it continued success. The work in their factory was continuing to increase; the new extensions would nearly double their working space. It was interesting to note that on Tuesday the company's cable ship *Norseman* left England with 900 miles of cable for repair work in the China seas. The concert by well-known artists was well received, and our visit was made more enjoyable by a tour of the works under the guidance of Mr. H. T. Locke (power cable stores manager).

Trade Announcements

Standard Radio Relay Services, Ltd., Bush House, Aldwych, W.C.2, informs us that a company known as Radio & Electrical Developments, Ltd., has been formed to acquire not less than 90 per cent. of Relay Services' issued share capital. (Particulars of registration are given in our "New Companies" section.) The new concern will be under the same management as Relay Services (which it is proposed shall go into voluntary liquidation) and the directorate is substantially the same. The purchasing for the group will be done in future by Rediffusion, Ltd.

The Astral Engineering Co., Ponders End, Middlesex, has changed its telephone number to Howard 2033.

Messrs. Graham-Farish, Ltd., of Bromley, Kent, announce that owing to increased cost of raw materials the price of their 150-W floodlight which was described in the ELECTRICAL REVIEW of January 29th is being advanced by 10 per cent. Prices of other models remain unaltered.

The R. & H. Electric, Ltd., has purchased the Taunton branch stocks of the Robinson & Hands Electric Co., Ltd., and is carrying on business as wholesale electrical and radio distributors at 63, Wood Street, Taunton. Mr. E. Nash, who for the past twelve years has been Taunton branch manager for the Robinson & Hands Electric Co., Ltd., is managing director of the new concern, particulars of which are given in the "New Companies" section of this issue. The company asks for manufacturers' catalogues.

Quick Work

Following a fire on February 19th at the British Thomson-Houston Co.'s "Mazda" lamp depôt at 6, West Street, Southampton, it has been necessary, in view of the extensive damage, to transfer this depôt temporarily to new premises

at 3, East Street, Southampton (telephone: Southampton 4389). To obviate any inconvenience to customers the company, when notified of the fire on Saturday morning, at once sent a representative to Southampton to find new premises and to make immediate arrangements for the transfer of stock, furniture and records. Replacement stocks of all types of "Mazda" lamps were quickly sent from London and a special staff worked throughout the week-end organising the new premises. The temporary depôt was opened for normal business on Monday last.

New Catalogues and Lists

Bill Switchgear, Ltd., Aston Lane, Perry Barr, Birmingham, 20.—Leaflets describing and illustrating "Royal" switches and switch-fuses, "Invicta" switches, and switch distribution gear with English Electric cartridge-fuses.

Johnson & Phillips, Ltd., Charlton, London, S.E.7.—Illustrated art booklets dealing with switchgear, transformers, and static condensers.

Whitehead Switchgear, Ltd., Windsor Works, Terry Road, Cardiff.—A catalogue of e.h.v. metal-clad oil pump pressure switchgear.

Herbert Morris, Ltd., Loughborough.—A booklet (pp. 64) entitled "Conveyors as a Means to Gain Greater Production."

Sturtevant Engineering Co., Ltd., 147, Queen Victoria Street, London, E.C.4.—A leaflet dealing with the No. 4 turbine vacuum cleaner.

Newalls Insulation Co., Washington Station, Co. Durham.—An illustrated art catalogue on fire protection of steelwork construction and electric cables with moulded asbestos.

Ruston & Hornsby, Ltd., Lincoln.—A complete illustrated catalogue of centrifugal pumps.

Yarrow & Co., Ltd., Scotstoun, Glasgow.—A new bound catalogue describing the company's activities and products in shipbuilding, engineering, and boilermaking.

V. & E. Friedland, 156, Fairfax Road, London, N.8.—Leaflets dealing with the new "Quickfit" combined transformer and bell, "Free Light" transformer lamp, and the "Lightspot" illuminated bell push.

Marconiphone Co., Ltd., Tottenham Court Road, London, W.1.—Details of a new range of "International" radio receivers.

Bankruptcy Proceedings

K. Nicholson, 8, Southgate, Bradford, and **F. Hyde,** 29, Swinton Place, Bradford, lately carrying on business in co-partnership under the style of The City Electrical Co., 8, Southgate, Bradford, and at 100 and 102, Morley Street, Bradford, as electrical contractors.—The public examination herein took place at the County Court, Manor Row, Bradford, on February 12th and was closed. The joint statement of affairs showed a deficiency of £396.

J. H. Maddox (lately trading as Imperial Electrical Supplies Co.), 14, Whitecross Place, Finsbury Pavement, E.C., dealer in electrical accessories.—This debtor, who petitioned the London Bankruptcy Court in September, 1932, applied on February 26th to Mr. Registrar Parton for an order of discharge. Trade depression and lack of capital were the causes of the failure. The discharge was suspended for six months.

H. H. Moore, Junior, "The Lindens," West Cliff Gardens, Bournemouth, electrical engineer.—This debtor attended at the Law Courts, Stafford Road, Bournemouth, recently for his public examination. He attributed his failure partly to underestimating. His statement of affairs showed ranking liabilities of £167, with assets of £1, leaving a deficiency of £166. The examination was formally adjourned.

C. Thornton, Radio Store, Main Street, Ffynnongroew, Flintshire, wireless dealer.—The public examination herein was held recently at the Castle, Chester. It was reported that the unsecured creditors' claims amounted to £175 and there were assets of £46, leaving a deficiency of £129. Debtor said his failure was due to bad debts, loss on motor car, costs of legal proceedings and illness of children. The examination was adjourned.

L. Smethurst, 155, Footscray Road, Eltham, S.E.9, late 17, Hanover Buildings, and 277, Shirley Road, Southampton, electrical and radio engineer.—The receiving order herein was made on the debtor's own petition recently, and according to the statement of affairs returned there are ranking liabilities of £1,525 and assets of £21, leaving a deficiency of £1,504. Debtor attributes his failure to depression in trade due to restrictive agreements and excessive competition.

H. E. Smith, radio and electrical engineer, High Street, Limpsfield, Surrey.—Receiving order made February 18th on debtor's own petition. First meeting March 10th at 29, Russell Square, W.C.2. Public examination April 22nd at the County Court, Croydon.

A. P. Steer, wireless dealer, 73a, Fore Street, Bovey Tracey.—First and final dividend of 2s. 8½d. in the £, payable February 26th at the Official Receiver's office, Exeter Bank Chambers, Broadgate, Exeter.

A. R. Carter, electrical contractor, 2, Priory Avenue, Mile End, Bridgend.—Public examination March 18th at the County Court, Bridgend.

D. L. Gibson (James Rush & Co. and the Hadrian Engineering Co.), wireless retailer and manufacturer, 31-33, Westgate Road and Back Eldon Lane, Newcastle-upon-Tyne.—Discharge suspended for two months until March 20th, 1937.

F. J. Couchman, wireless and electrical engineer, 1, High Street, Sturry.—Last day for receiving proofs for dividend March 10th. Trustee, Mr. F. C. Wells, 1, The Parade, Canterbury, Official Receiver.

J. H. Pasco (J. Danning), wireless engineer, 10, New Bridge Street, Truro.—First and final dividend of 2s. 4½d. in the £, payable March 1st at 12, Princes Street, Truro.

C. W. Coombes, electrical engineer, "Verdley," Portsmouth Road, Milford, Surrey.—Last day for receiving proofs for dividend March 12th. Trustee, Mr. C. R. Waterer, 19, Russell Square, W.C.1. Official Receiver.

H. J. Couzens, electrical contractor, 165, Young Street, Sheffield.—Trustee, Mr. H. Cunningham, 189, Norfolk Street, Sheffield, released February 5th.

W. H. Hammond, radio and electrical engineer, 18, Church Street, Leamington Spa.—Last day for receiving proofs for dividend March 13th. Trustee, Mr. C. J. Band, 9-11, High Street, Coventry.

R. S. Lees, lately trading at R. S. Lees & Co., 21, Gledhow Park Road, Leeds.—First and final dividend of 9d. in the £, payable March 11th at 24, Bond Street, Leeds.

R. E. Graham, lately trading as wireless engineer at 793, Oldham Road, Newton Heath, Manchester, and now residing at 42, Seymour Drive, Ellesmere Port.—Adjudication annulled and receiving order rescinded, the whole of the debts provable in the bankruptcy having been incurred by the bankrupt before attaining the age of twenty-one years.

Company Liquidations

A.B. Electric Co., Ltd., 60, Newman Street, W.1, electrical wholesalers.—The statutory meeting of creditors herein was held on February 24th at Essex Hall, W.C.2, when Mr. H. A. Snelling, a director of the company, presided. No statement of affairs was submitted, but according to a balance sheet prepared at February 12th last the liabilities amounted to £6,112, and included issued share capital £1,850, bank overdraft £42, sundry trade and expense creditors £3,437, and directors' current accounts £783. On the other side there was goodwill £500, preliminary expenses £150, fixtures and fittings £134, motor car £32, stock in trade estimated at £1,045, sundry debtors, deposits and apportionment £2,180, cash in hand £5, and profit and loss account £2,066. The voluntary liquidation of the company was confirmed with Mr. F. E. Bendall, of Bendall, Poppleton and Appleby, 4, Charterhouse Square, E.C.1, as liquidator, with a committee of inspection.

Featherstone Wholesale Radio-Elec, Ltd.—Particulars of claims by March 5th to the liquidator, Mr. W. A. J. Osborne, Balfour House, Finsbury Pavement, E.C.

Abar Electrical Co., Ltd.—Meeting March 24th at 150, Southampton Row, W.C., to receive an account of the winding-up by the liquidator, Mr. F. T. Smith.

A.S.E., Ltd.—Winding-up voluntarily. Liquidator, Mr. W. R. Parker, 66, Victoria Street, S.W.1.

F. E. Doran, Ltd.—Meeting March 25th at 67, Watling Street, E.C.4, to receive an account of the winding-up by the liquidator, Mr. H. Wingfield.

Private Arrangements

L. W. Meredith, electrician, &c., Prince George Street, Skegness.—The creditors herein met recently at Skegness, when the statement of affairs showed ranking liabilities of £3,401. After allowing £102 for preferential claims the net assets were £1,465, leaving a deficiency of £1,936. It was decided that the debtor should be allowed time in which to submit an offer of 5s. in the £, with details of further payments, satisfactory to the creditors, to be made at subsequent dates, to discharge the liabilities in full.

L. Charlton, trading as Sleigh & Wood, electrical engineers, 12-14, North Street, Newcastle-on-Tyne.—At the meeting of the creditors of the above the statement of affairs showed ranking liabilities of £2,022, and in addition there were fully secured creditors for £592. The net assets were £1,185, leaving a deficiency of £837. The debtor stated that he could obtain assistance from friends who would guarantee a composition of 7s. 6d. in the £, payable within one month. It was decided that the debtor should be allowed seven days in which to find guarantors for the payment of a cash composition of 7s. 6d. in the £, failing which the matter should be dealt with under a deed of assignment.

A. G. Drew, trading as Bridge Radio Stores, 6, Randleston Road, Bellingham, S.E.6.—At a meeting of the creditors of the above it was reported that the liabilities totalled £276, of which £252 was due to the trade and the balance to preferential creditors. There was a surplus of assets over liabilities of approximately £186. It was decided that debtor should be granted a moratorium for six months and that during that time the business should be carried on under the supervision of Mr. C. Latham, of the Radio and Gramophone Trades Guardian Association, 185-188, High Holborn, London, W.C.

Neville & Joyce, electrical engineers, 4, Upper Duke Street, Liverpool.—A meeting of the creditors of the above was held recently, when the chair was occupied by the representative of Baxendale & Co., Ltd. The statement of affairs disclosed liabilities of £417 and net assets of £187, leaving a deficiency of £231. An offer was made of a composition of 10s. in the £, payable as to 2s. 6d. in cash and the balance by three equal monthly instalments, which it was decided should be accepted. A committee was also appointed consisting of representatives of the three principal creditors.

C. Roddis, electrical engineer, 11, Nelson Street, Bradford.—The creditors herein met recently at Bradford, when it was reported that the liabilities amounted to £106, and in addition there were fully secured creditors for £359. After allowing £16 for preferential claims the net assets were £31, leaving a deficiency of £75. The present position was attributed to lack of capital and insufficient turnover. In the absence of any offer it was decided that the estate should be wound up under a letter of authority to Mr. J. E. Lindsey, accountant, Manchester Road, Bradford, and the proceeds distributed pro rata amongst the creditors.

Dissolution of Partnership

Bennett & Co., manufacturing electrical engineers and contractors and general electrical factors, 13, Sackville Street, W.1, and 8, Greaves Place and 876, Garratt Lane, Tooting, S.W.17.—Messrs. P. Bennett and W. Dawson have dissolved partnership. Mr. Bennett will attend to debts and carry on the business.

W. Bradley & Sons, electrical engineers and contractors, 75, York Road, Woking.—Messrs. R. W. Bradley and J. J. L. Bradley have dissolved partnership. Mr. R. W. Bradley will attend to debts and carry on the business.

Widcombe Radio & Electrical Service, radio and electrical engineers, 4, Sussex Place, Widcombe, Bath.—Messrs. W. E. Miller and M. G. Monger have dissolved partnership. Mr. Miller will attend to debts and carry on the business.

Electricity Supply

Lighting, Domestic, Power

Australia.—BRISBANE.—Mr. J. H. Hindman, the manager, states that the Electricity Supply Department experienced a satisfactory year in the period to June 30th last, there being a profit of £53,684, despite reductions in tariffs. Sales, exclusive of public lighting, amounted to 39.4 million kWh, against 32.8 million kWh in the previous year, while consumers numbered 50,496 (47,295) and the average consumption per consumer was 780 (694) kWh. In addition, 1.7 (1.5) million kWh was used for public lighting. During the year the Department continued its assisted-wiring scheme, which was further justified by the large number of applications received, while in an endeavour to make supplies available in the whole of the area the required return on outlay was reduced from 20 to 10 per cent. During the year a broadcasting station was put into service by the Council and the maintenance transport fleet was equipped with suitable receivers. This service has already proved of considerable value, particularly during storms, and has resulted in an appreciable saving of time and inconvenience to consumers. A booklet, "Electrical Topics," has been well received and is to be enlarged. Among works carried out during the year was the completion of a 33,000-V line to the Stanley River Dam works. Underground feeder laying entailed 3.23 miles of cable, while overhead lines, both high- and low-voltage, were erected to the extent of 132.5 miles, the total route miles of overhead at June 30th being 912.33.

Bristol.—SPECTACULAR FLOODLIGHTING.—From March 1st to 15th a display of Coronation decorations is being shown at the premises of Yeo Bros., Paull & Co., Ltd., Bristol. In connection with the display a special floodlighting installation

A Coronation display at Bristol

has been planned and carried out by B.T.H. engineers in collaboration with the Bristol company, and on March 1st this was switched on by the Lord Mayor. Fourteen "Mazdalux Four" projectors with 1,000-W "Mazda" line filament lamps and three with 500-W lamps are used for the upper portion of the building, while eleven "Mazdalux Five" projectors, each with two 150-W pearl lamps are employed for the lower half of the premises. Temporary balconies have been built on the first and third floor levels, and these carry a crimson pelmet screening the projectors. The fronts of the balconies are decorated with Coronation emblems and illuminated devices.

Cardiff.—SUPPLY TO STEELWORKS.—At a cost of £30,000 a third feeder is to be constructed for the British Guest Keen Baldwins Iron and Steel Co.'s works at East Moors, Cardiff. The Electricity Committee was informed by Mr. Edward Jones (city electrical engineer) that the steel works were to be extended next winter to a capacity of 17,000 kVA.

Cheltenham.—MAINS AND SERVICES.—Sanction to borrow £15,000 for mains and services is being sought by the Electricity Committee.

Dover.—DOMESTIC WATER-HEATERS.—A scheme for the hiring of 1½-gal. water-heaters has been recommended for adoption by the Electricity Committee. Santon apparatus has been chosen, and it is proposed to charge 2s. 6d. per quarter where an electric cooker is used and 3s. otherwise.

East Ham.—MAIN ROAD LIGHTING.—Sanction to borrow £7,828 for main road lighting with mercury-discharge lamps has been obtained by the Corporation.

Eston.—METERS.—The Electricity Committee is to borrow £1,000 for meters.

Great Britain.—STORM DAMAGE.—Electricity supply services in various parts of the country were interrupted owing to damage to overhead equipment during the high winds and snowstorm last week-end. The worst effects seem to have been experienced in North Wales, where damage to the North Wales Power Company's lines caused a breakdown in the supply to Llandudno, Colwyn Bay, Conway, Llandudno Junction, Deganwy, Llanddulas, Abergele and Rhyl. The failure resulted in the new B.B.C. transmitter at Penmon being put out of commission. In Monmouthshire, Abertillery was without electricity for some hours, while the supply to Pontypool was also affected. On the west coast there was a failure at Cardigan. Elsewhere, villages in Wensleydale, Yorkshire, and towns and villages in South Dorset were deprived of electricity supplies owing to overhead lines being damaged.

Halifax.—A PERMANENT COMMEMORATION.—On the recommendation of the borough electrical engineer and manager (Mr. G. A. Vowles) the Light, Heat and Power Committee has decided that instead of spending £600 on floodlighting and illumination of public buildings at the Coronation, £400 of the amount will be expended on the installation of electric-discharge lighting along one of the main thoroughfares. Special plaques will indicate that the installation was carried out by the Electricity Department to commemorate the Coronation of King George VI.

Hebden Bridge.—EXTENSION OF SODIUM LIGHTING.—The Council last week decided to extend the system of main road street lighting by sodium lamps.

Hornsey.—ELECTRIC STREET LIGHTING.—Last summer the Council decided to convert the lighting of the roads in the borough (excluding classified roads) from gas to electricity, and the scheme was again under discussion at the recent meeting of the Council. Replying to a councillor, the chairman of the Electricity Supply Committee (Alderman Moritz), explained that the provision of electric street lighting was bound up with the change-over of the system from d.c. to a.c., which would take some time. However, by a rearrangement of their programme, they were able to ensure that many of the main roads would have a.c. cables before next September so that progress could be made with the street lighting. As some of the roads that should be dealt with at once did not fall within that programme it was decided to lay a.c. cables in such roads sooner than originally intended, the Highways and Lighting Committee to assume responsibility for the interest on capital prematurely expended.

Hull.—PETITION FOR ELECTRIC WASH-BOILERS.—At a recent meeting of the Electricity Committee it was stated that a letter had been received asking that electric wash-boilers should be installed in place of the gas type in houses on the East Hull estate. The electrical engineer (Mr. J. N. Waite) stated that they could not supply electric wash-boilers unless they were asked to do so by the Housing Committee. A number of people had had electric boilers put in at their own expense and others were now wanting them, but did not wish to pay for them. It was decided that the Electricity Committee should suggest to the Property Committee that if and when the coppers were renewed electric wash-boilers should be installed under the hire scheme.

NEW STREET LIGHTING.—Improvements in the lighting of Boothferry Road and Askew Avenue are being carried out by the Electricity Department. In the near future an experiment with sodium lighting is to be carried out in a portion of Clough Road. This will be the fourth thoroughfare in the city to have this type of lighting.

London.—WANDSWORTH.—The Borough Council has decided to have electricity installed in all the houses, maisonettes and flats under its control. Altogether 1,381 dwellings are involved. The Council will collect the standing charges of the County of London Electric Supply Co., Ltd., for which it will receive 5 per cent. commission. All the tenants concerned have been informed that the installation of electricity will involve a weekly payment by them, including the standing charge, of 1s. 4d. per week in respect of each house and 1s. 2d. in respect of each maisonette and tenement flat, in addition to their rent. All electricity used is to be paid for through slot meters at ½d. per kWh. The replies received show that 82 per cent. of the tenants desire electricity on these terms.

HOSPITAL REWIRING.—The L.C.C. is to rewire the Fulham Hospital and Institution, St. Mary Abbots Hospital and Institution, and the St. Andrew's, St. Giles', Northern and South-Eastern Hospitals at a cost of £56,310. The work will be spread over several years.

POPLAR.—Still greater expenditure on wiring installations for new consumers for lighting, heating and cooking and water heating is anticipated by the electrical engineer, and the Electricity Committee has therefore decided to apply for sanction to borrow £60,000 for the purpose.

Lytham St. Anne's.—ELECTRICAL DEVELOPMENT.—Sanction is being sought by the Electricity Committee to a loan of £30,000 for expenditure on electrical works during the ensuing three years.

Maltby.—WIRING COUNCIL HOUSES.—It has been decided to equip about 140 Council houses with electrical installations.

Northampton.—SUB-STATION.—The Northampton Electric Light and Power Co., Ltd., is to erect a sub-station in Spencer Bridge Road.

North Westmorland.—CABLE ACROSS LAKE.—The Westmorland and District Electricity Supply Co., Ltd., is considering laying a cable across Ullswater to supply power to the Greenside lead mines at Glenridding, and has asked the North Westmorland Rural District Council for its views on the matter. The cable would be continued underground for a distance on each shore. The Council has appointed a committee to meet representatives of the company to discuss the scheme.

Oswaldtwistle.—STREET ILLUMINATION.—Terms for lighting new streets and roads at Intack by electricity supplied by the Accrington undertaking have been accepted by Oswaldtwistle Council.

Salford.—SUB-STATION.—Sanction is being sought by the Electricity Committee to a loan of £47,500 for the provision of a sub-station in Scholes Lane and for plant for various sub-stations, &c.

SWINTON AND PENDLEBURY SUPPLY.—Authority has been given for steps to be taken with a view to the bulk supply of electricity required by Swinton and Pendlebury Council being afforded by the Salford undertaking.

Sheffield.—EXTENSIONS.—The Electricity Committee has approved extensions of mains costing £12,159.

REDUCED CHARGES.—As from April 1st it is proposed that the following lower charges shall come into force: Slot-meter consumers, 4d. per kWh; Corporation departments and voluntary hospitals, 1.5d. per kWh for lighting and 0.275d. per kWh for heating; power consumers paying on a coal clause basis, "unit" charge for variation in the price of coal to be 0.001d. for each 1d. increase or decrease in the cost of coal per ton above or below 12s. 6d. The estimated cost of the reductions is £27,000 per annum.

Southport.—SWITCHGEAR.—The Electricity Committee is to replace switchgear at Preston New Road sub-station at a cost of £850.

Stoke-on-Trent.—FRINGE ORDER.—As a number of applications have been received for supplies to premises in Ball Green, outside the city, the Electricity Committee has decided to apply for a Fringe Order.

SUB-STATIONS.—The loan obtained for general sub-station extensions having been almost exhausted, the Committee is to ask for sanction to the borrowing of a further sum of £25,000. Among sub-station and supply improvements approved by the City Council are the following: Extensions and re-equipment of British Pottery sub-station, Tunstall (£1,650); extra-high-voltage and low-voltage mains and sub-station equipment for a sub-station at Brindley Ford (£2,200); new distributor for Park Avenue, Wolstanton (£500); additional transformer for Dimsdale sub-station, Wolstanton (£400); additional transformer and low-voltage distributor, Meir sub-station (£930); sub-station, equipment, and extra-high-voltage and low-voltage mains for the North Staffordshire Royal Infirmary sub-station (£6,165); new low-voltage, a.c. main for London Road, Stoke-upon-Trent (£800); and new mains and feeder pillars, Oakhill district (£400).

Stalybridge and District.—CHEAPER ELECTRICITY.—We are informed by Mr. J. Harwood Lumsden, the chief engineer, that the Stalybridge, Hyde, Mossley and Dukinfield Transport and Electricity Board has revised the tariffs, despite the fact that the Board will have to pay a further £10,000 during the next twelve months for coal. The fixed charge on the "all-in" domestic and doctors' and dentists' tariff has been lowered; minor reductions have been made in the shops and offices lighting tariff and the power tariff.

Sutton Coldfield.—DISTRIBUTION.—The Electricity Committee is seeking sanction to borrow £25,000 for distribution works.

E.H.V. RING MAIN.—Cables are to be laid by the Electricity Committee between the Wylde Green sub-station through Walmley to a transformer kiosk, thus completing an extra-high-voltage ring main round the eastern side of the system; the Committee is also to provide a 4-cubicle type 11,000-V switchboard and a 1,500-kVA, 11,000/6,600-V transformer with on-load tap-changing gear.

Tamworth.—STREET LIGHTING.—The tender of the Tamworth District Electric Supply Co., Ltd., for a seven years' contract to light the streets in the whole of the borough has been accepted by the Town Council.

Whitby.—SUPPLY TO GOATHLAND.—The North-Eastern Electric Supply Co., Ltd., proposes to supply electricity to Goathland.

Traction

Bradford.—TROLLEY-BUSES TO REPLACE TRAMS.—The Finance Estimates Sub-Committee has approved expenditure of about £49,000 on a scheme for the substitution of trolley-buses for trams on the Wakefield Road route, a distance of just over three miles.

Hull.—TROLLEY-BUS SERVICE.—The Transport Committee announces that the first trolley-bus service in the city will start about the end of this month. A five-year scheme will then be entered upon, at the end of which the tramways system will have been totally abandoned.

London.—TUBE RAILWAY EXTENSION.—In connection with the proposed extension of the Central London tube railway, the London Passenger Transport Board has now placed a contract with Charles Brand and Son, Ltd., for boring the tunnels between Liverpool Street and Mile End.

South Africa.—PRETORIA.—It is proposed that trolley-buses shall be substituted for the trams.

Southampton.—CONTRIBUTION IN AID OF THE RATES.—The Transport Committee proposes to set aside a sum of £5,750 in aid of the next general rate. The amount is slightly larger than last year.

Southern Railway.—ANSWER TO THIRD-RAIL CRITICS.—Speaking at the fourteenth annual meeting of the company last week, Mr. R. Holland-Martin stated that the company's Bill, which contained scarcely any contentious matters, had been persistently blocked in the House of Commons for no reasons connected with opposition to anything contained in the Bill, but because the objectors alleged that the extension of the third rail system into rural districts was dangerous. After dealing with the precautions taken by the company in the way of fencing, footbridges, interruption of the third rail at cattle crossings, etc., and pointing out the impracticability of suggested alterations, he said that the accidents attributable to shock had been confined to a few persons who had climbed over the fence. The public must realise that a railway line, with its fast and increasing service of trains and with the additional danger of the electric rail, differed little in negotiability from a fast-flowing fordable river, and should only be crossed where crossings were provided. Were this recognised the number of fatalities, now remarkably few compared with those resulting from other forms of transport, would be confined to those who got on the line with intent to destroy themselves. In the course of his address Mr. Holland-Martin revealed that of the £1,719,000 capital expenditure during the year £983,000 was on electrification of the line, while the item of £456,000 in respect of rolling stock included expenditure on electric stock. As compared with 1932, the increase in the number of passenger journeys throughout the system was 43,000,000, and of these the electrical area claimed 35,000,000. This represented a growth in the number carried in the electrified area of 15 per cent. and an increase in the passenger receipts in that area for 1936 of no less than £1,054,000, or nearly 17 per cent.

Tynemouth.—HIGH-SPEED "TUBE" SCHEME.—A communication from Arthur Whitley, Ltd., contractors, London, asking

A Bridge for E.H.V. Cables

OWING to the Metropolitan Electric Supply Company's sub-station at Uxbridge being close to the Grand Union Canal the laying of e.h.v. cables on the Uxbridge-Slough feeder route (38 miles) made it necessary to design and erect a special cable bridge to cross the canal; to allow for the correct bending radii of the cables a concrete chamber at the base of the bridge was constructed. (Two views of the bridge are illustrated on page 362.)

The Callender-Hamilton "unit construction" type of bridge was adopted, this being the first occasion on which it has been used exclusively for cable work in this country. The full capacity is twenty-four cables, with auxiliaries, and racks have been supplied and erected for eight cables, the remainder to be carried from centre supports. The whole of the bridge and supports is being covered by a patent steel sheeting and is fireproof. For access during the hours of darkness a lighting installation has been provided.

The work, carried out by Callender's Cable & Construction Co., Ltd., consisted of the supply and laying of a three-core 0.25 sq. in. 25,000-V cable, laid direct for the greater portion of the four sections, but in other cases drawn into existing earthenware pipe and, where special obstructions were encountered, drawn into steel pipes laid in concrete. In addition, one three-core pilot cable and one 14-pair telephone cable were also supplied and drawn into earthenware pipes. Along the greater portion of the route 6 in. and 4 in. earthenware pipes were also supplied and laid and a reinforced concrete cover was provided for protection and placed over the feeder cable where laid direct. Mild steel pipes in concrete were laid in positions either under or over railway bridges and across rivers. For approximately ¾ mile these cables were laid along the towpath of the Grand Union Canal and the cables and pipes were covered by a specially designed mild steel plate, bent to give the necessary protection. The work also included the supply and fixing of approximately 400 straight joints on the e.h.v. cable and a similar number of joints on the auxiliary cables, together with the usual jointing work at all terminations.

These cables carry energy from the Willesden power station of the London Power Co. for giving bulk supplies to the various sub-stations in the Metropolitan Electric Supply Co.'s area for reinforcing its ring mains. The work was completed in December and Callender's found it necessary to employ about 700 men for almost the whole working period.

whether the Council would consider the construction of a Kearney tube railway between North Shields and South Shields railway stations is being placed before the Parliamentary Committee, states the *Passenger Transport Journal*. In 1928 a Select Committee of the House of Commons rejected a scheme for the construction, between South Shields and Tynemouth, of a tube railway designed by Mr. E. W. Kearney.

Communications

Great Britain.—RELAY EXCHANGE LICENCES.—In the House of Commons on March 1st Mr. Graham White asked the Postmaster-General if he would state the number of licences for relay exchanges granted during 1936; the number of licences not renewed; and the total number at the latest convenient date. Major Tryon said that during 1936 one new relay exchange licence was issued and four licences lapsed owing to the closing of the exchanges. The total number of licences in force on December 31st, 1936, was 333. Arrangements were being made for the renewal of these licences for a further period of three years, subject to compliance with certain conditions; and with the addition of one new licence issued since December 31st last the total would be 334.

TELEPHONE SERVICES INTERRUPTED.—The *Daily Telegraph* states that more than 130 telephone exchanges were put out of action by the storm last week-end.

TELEPHONE DEVELOPMENT.—Speaking at the annual meeting of the Telephone Development Association in London last week, the retiring chairman, Col. Sir Thomas F. Purves, O.B.E., said there was ample confirmation of the truth of the contention, consistently urged by the Association, that the most effective means of promoting telephone growth and creating the telephone habit in Great Britain was the policy of progressive reduction in charges, side by side with the maintenance of a high standard of service. Sir Thomas said they particularly welcomed the evenness of the figures of telephone growth during the last few years, a progression which was well illustrated in the figures given in the House of Commons by the Postmaster-General a fortnight ago. The work which was being done in teaching the use of the telephone in schools was bound to have far-reaching results. They had, up to February 16th, covered 258 schools, representing an audience of 23,648 children, almost all on the point of leaving school and entering upon some kind of business or professional career. They were booking lecture dates as far ahead as May, 1938. Sir Thomas said he could not refrain from expressing his pleasure in the fact that the great public services of the engineer-in-chief, Sir George Lee, had been recognised by the well-deserved honour recently bestowed on him by the King. In the transfer of Mr. John Innes from the position of assistant engineer-in-chief to that of assistant secretary one saw a welcome indication that the Post Office recognised the function of the "engineering mind" as a factor in telephone administration, and that it was ready to treat the whole staff as a common pool from which the right men would be selected to fill the right places.

Norway.—MARITIME RADIO EQUIPMENT.—With a mercantile marine of nearly 1,900 ships over 100 tons, representing a total gross register tonnage of approximately 4,000,000, Norway is the world's third largest shipping nation, and the question of radio communication is thus of more than ordinary importance. In view of the forthcoming restriction of spark-transmitters in 1940, there is a good market for maritime radio equipment in Norway. In the large fishing-fleet which operates in the waters off the Norwegian coasts and the vessels which are concerned with seal-catching farther north, there is a growing demand for such equipment. The individual vessels of whaling expeditions in the Antarctic are nowadays not only able to remain in constant touch with the base ship, but are also in communication with each other. All the vessels are, moreover, equipped with radio direction-finding apparatus. Mr. Olaf Moe, chief engineer of the Telegraph Office, dealing with the subject in an article which appeared recently in *Norges Handels og Sjofartstidende*, believes that it is only a question of comparatively little time before all larger vessels will have s.w. outfits. A well-known German firm is spending a good deal on advertising its special "radio telephony outfit for fishing-vessels" in Norway. There is undoubtedly a market in Norway to which British exporters should pay attention. It is worth while remembering that there is likely to be a very marked demand for receivers, notably with at least one stage of h.f. amplification, to replace sets at present in use, mostly of the ordinary detector type with one or two stages of l.f. amplification.

An Improved Glasgow Tramcar

THE first of two new double-deck tramcars which the Glasgow Corporation Transport Department is building experimentally has now been completed. Measuring 34 ft. long by 7 ft. 4 in. wide, it constitutes a notable advance in design on those at present operated in the city. Restrained streamlining and shaped windows give it an attractive external appearance.

Two equal wheel bogies manufactured by the E.M.B. Co., Ltd., are used, and are sprung by long laminated axle-box springs which reduce the unsprung weight. Small-pitched vibrations from the wheels are prevented from reaching the car body by the use of heavy section rubber shock absorbers in the track bolster. These rubber pads are so arranged that they will deflect in a transverse direction when the tram is entering a curve and a longitudinal direction when the tram is accelerated and braked. Many expedients to overcome noise and shock have been adopted.

The windows, which are all glazed from the outside, were designed by the Transport Department, of which the general manager is Mr. J. N. Wilson. A notable feature of the upper saloon is the armour plate glass panels on each side of the roof to give better natural lighting. The bow collector, standard in Glasgow, is again used.

The complete electrical gear was supplied by the Metropolitan-Vickers Electrical Co., Ltd. A 35-h.p. motor is mounted on each axle and the control equipment is electro-pneumatic. It is anticipated that this gear will considerably reduce the burning of contacts. A battery energises the control circuit so that the switches can still be operated to give rheostatic braking in the event of the failure of power from the overhead line. Each bogie is fitted with a pair of track magnets, each capable of a vertical pull of 5,000 lb. at 70 A. The braking is air wheel and magnetic, with the addition of an air track brake. The total seating capacity is sixty-five.

Both saloons are heated by tubular heaters instead of the upper saloon only, as is the case in the standard tram. The ventilation is a special feature of the car. Four silent-running fans connected in series and fitted in ducts ensure a minimum of ten changes of air per hour, with a maximum of sixty changes per hour.

There are two distinct types of lighting. The lower saloon fittings were supplied by Holophane, Ltd., and are of the semi-concealed type. There is no glare and the lighting intensity in foot candles has been increased by 200 per cent. over the standard car. The units for installation in the upper saloon were supplied by G.V.D. Illuminators, Ltd.

Views of the new Glasgow tramcar, showing the lighting fittings of the lower saloon

Other notable features on this tram include loudspeakers for announcing the next stopping place.

Contract Information

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Contracts Open

Australia.—MELBOURNE.—March 31st. State Electricity Commission of Victoria. Dust-collecting plant, including induced draught fans, for two boiler units at the Yallourn power station. Agent-General for Victoria, Victoria House, Melbourne Place, London, W.C.2.

Barnoldswick.—March 13th. U.D.C. Electricity Department. P.i. cables for one year. (See this issue.)

Bishop's Stortford.—March 15th. U.D.C. Automatic electrically driven sewage pumping plant (70,000-gal. per hr.) and incidental works at the Sewage Works. Surveyor, Council House (deposit £2 2s.).

Blackpool.—March 11th. Borough Council. 6,600-V switchboards and control gear. (February 26th.)
March 16th. Electricity Department. One year's supply of electricity meters. (See this issue.)

Bristol.—March 15th. City Council. Diagnostic X-ray plant, superficial therapy plant, and light department at the Central Clinic. (February 26th.)

Bromley. — March 15th. Electricity Department. Transformers. (See this issue.)

Burnley.—March 15th. Electricity Department. Switchboard, switch and isolator gear with metering equipment, isolator and bus-bar unit, cable and transformers. (February 26th.)

Cannock.—March 15th. U.D.C. Electricity Department. Switchgear and transformer. (February 19th.) An error occurred in the advertisement appearing in our February 19th issue. The 3,000-kVA transformer required is to be oil cooled —not air cooled as stated.

Cleethorpes.—March 15th. Borough Council. One 250-kVA transformer. (See this issue.)

Dartford.—March 20th. Borough Council. Cable. (See this issue.)

Dewsbury.—March 15th. Electricity Undertaking. Cable and transformers. (See this issue.)

Dover.—March 15th. Corporation. Rewiring Town Hall buildings. (February 26th.)

Dundee.—March 10th. Corporation. Cable. (See this issue.)

Epsom & Ewell.—March 15th. U.D.C. Electricity Department. Meter-testing equipment and cable. (See this issue.)

Erith.—March 17th. U.D.C. Electricity Department. One four-panel switchboard with extension switch and sub-station metering equipment. (February 26th.)

Falkirk.—March 12th. Electricity Department. Two 500-kVA transformers. (February 26th.)

Fife.—March 17th. County Council. Electric lighting in 112 houses at East Wemyss. J. Gentles & Son, Central Chambers, Kirkcaldy (deposit £1 1s.).

Gellygaer.—March 15th. U.D.C. Electricity Department. Electrical stores for one year. (February 26th.)

Great Western Railway.—April 1st. Telegraph ironwork and electric lamps. (See this issue.)
April 23rd. Insulated v.i.r. cables. (See this issue.)

Hamilton.—Electricity Department. L.v. and e.h.v. cables. (See this issue.)

Heckmondwike.—March 17th. U.D.C. Motors and control gear, meters and radio apparatus for a d.c. to a.c. change-over scheme. (See this issue.)

Heston and Isleworth.—March 11th. Electricity Department. Switchgear, transformers, and sheet-steel kiosk. (February 26th.)

Hove.—March 16th. Electricity Department. Electrical stores for one year. (See this issue.)

Huddersfield.—March 19th. Corporation. Electric lifts at the new electricity showrooms. (See this issue.)

India.—NEW DELHI.—March 18th. Stores Department. Twelve months' supply of electric table standards, shades, lamp holders and locks. (T. 31178.)*
April 24th. Wall plugs and sockets, ceiling roses and porcelain connectors. (T. 31182.)*
ASSAM-BENGAL RAILWAY CO.—March 22nd. Motor-driven air compressor. (See this issue.)
BENGAL AND NORTH-WESTERN RAILWAY CO.—March 23rd. Electric lamps. (See this issue.)

Irish Free State.—ELECTRICITY SUPPLY BOARD.—April 30th. One 20,000-kW turbo-alternator and exciter, with condensing and auxiliary plant for the Pigeon House generating station, Dublin. (See this issue.)

Kearsley.—March 15th. U.D.C. Twelve months' supply of electric lamps. J. F. Moyse, surveyor, Town Hall.

Langho (Nr. Blackburn).—March 17th. Committee of Management of the Brockhall Institution for Mental Defectives. Twelve months' supply of electric lamps. F. J. Collins, clerk to the Committee, The Institution.

London.—METROPOLITAN WATER BOARD.—March 19th. Electrically driven pumps, &c., at the Barnes Works, Lonsdale Road, Barnes. Chief engineer, Offices of the Board, 173, Rosebery Avenue, E.C.1 (deposit £2 2s. to the Comptroller).

Manchester.—March 23rd. Electricity Committee. Cables and service cut-outs for one year. (See this issue.)

Middlesex.—March 15th. County Council. Medium pressure main switchgear at the Central Middlesex County Hospital, Willesden. (February 26th.)

Middleton.—March 10th. Electricity Department. Cables. Borough electrical engineer, Corporation Street.

Milford Haven.—March 9th. U.D.C. Electricity Department. Electrical goods for twelve months. (February 26th.)

Newcastle-upon-Tyne.—March 29th. Transport and Electricity Committee. 600-kW mercury-arc rectifier sub-station equipment. (See this issue.)

New Zealand.—WELLINGTON.—May 25th. Public Works Department. Oil circuit-breakers and spares. (T. 31188.)*

Paisley.—March 22nd. Corporation. Electric lighting in 1,276 houses on the Ferguslie Park estate. Master of Works' Office, 16, Gilmour Street.

Portsmouth.—March 16th. Electricity Undertaking. Two 420-kW rectifier equipments. (February 26th.)

Preston.—March 11th. County Mental Hospital, Whittingham. Various stores, including electric lamps, for twelve months. J. R. Bishop, clerk and steward, the Hospital.

South Africa.—JOHANNESBURG.—March 13th. City Council. 1,100 cable end boxes. (T.Y. 31171.)*
PRETORIA.—March 26th. Public Works Department. Electric clocks. (T.Y. 31184.)*
April 9th. Electric cooking apparatus, refrigerators and food preparation apparatus. (T.Y. 31195.)*
PORT ELIZABETH.—April 8th. Municipality. Transformers, cable, switchgear. (T.Y. 31199.)*

South Kesteven.—March 16th. R.D.C. Two electrically driven horizontal type centrifugal pumps, with a stand-by plant driven by vertical type Diesel engines. C. W. Bell, clerk, 41, North Street, Bourne.

Southport.—March 16th. Borough Council. E.h.v. switchgear. (See this issue.)

Stanley.—March 18th. U.D.C. Electricity Department. Electrical stores for one year. (See this issue.)

Sutton and Cheam.—March 15th. Corporation. Electrical work at Cheam Baths and Public Hall, Malden Road. (February 26th.)

Tottenham.—March 17th. Education Committee. Electrical installation in the Woodlands Park school. (See this issue.)

Urmston.—March 11th. U.D.C. Electric lamps for one year. E. L. Leeming, surveyor, Council Offices.

Uruguay. — MONTEVIDEO. — April 16th. State Electricity Supply and Telephones Administration. Underground armoured telephone cable. (T.Y. 31172.)*
April 19th. V.i.r. cable. (T.Y. 31192.)*
April 22nd. Copper wire conductors. (T.Y. 31191.)*
April 26th. L.c. cable. (T.Y. 31180.)*

Walsall.—March 17th. Electric Supply Committee. Remote supervisory control equipment and fire protection installation. (See this issue.)

Walton and Weybridge.—March 16th. U.D.C. Electricity Department. Electrical materials for period ending March 31st, 1939. (February 26th.)

West Riding.—March 15th. Public Assistance Committee. Various works, including electrical and heating, at the alterations to the nurses' home at the County Poor Law Institution, Pontefract. P. O. Platts, County Hall, Wakefield.

Worthing.—March 11th. Corporation. E.h.v. and l.v. cables. (February 26th.)

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* Further particulars from the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, London, S.W.1.

Contracts Closed

Amble.—U.D.C. Accepted. Laying underground cables in the High Street (£276).—B. I. Cables.

Barking.—Highways Committee. Recommended. Electric-discharge lighting in Alfred's Way (£1,762).—Siemens Electric Lamps & Supplies.

Cheltenham.—Housing Committee. Accepted. Wiring 283 houses on the St. Paul's and St. Peter's estates (£2,459).—Henderson & Priestley.

Durham.—County Council. Accepted. Electrical installation at the new Mental Colony, School Aycliffe, Darlington (£7,160).—W. J. Furse & Co. (Manchester).
County Education Committee. Accepted. Electrical installations in schools: Catchgate Council (£234).—T. W. Atkinson. Wheatley Hill New Council (£300).—R. Robson.

East Riding.—East Riding and York Joint Hospital Board. Accepted. Electrical installation at staff houses at Mental Colony (£134).—Napier & Wheeldon. Cables (£215).—Callender's.

Finchley.—Electricity Committee. Accepted. One 5-cwt. electric van (£365), two 15-cwt. electric vans (£860) and three charging rectifiers (£233).—Met.-Vick. Elecl. Co.

London.—STOKE NEWINGTON.—Electricity Committee. Recommended. Supplies for twelve months: Cables.—Henley's. Electric cookers.—Simplex Electric Co. Disconnecting boxes and pavement frames.—W. Lucy & Co. Electric kettles and wash boilers.—Revo Electric Co. Meters.—Aron Electricity Meter; Rex Meters. Meter boards.—British Insulated Cables. Conversion of radio apparatus.—Radiomenders, Ltd. Electric water-heaters.—English Electric Co.; Heatrae, Ltd.; Johnson & Phillips. Installation work.—W. B. & H. C. Cables.
POPLAR.—Contracts Committee. Accepted. Supplies for twelve months: Switchgear.—Harland Engineering Co.; English

Electric Co. Transformers.—G.E.C. Cables.—Standard Telephones; Mersey Cable Co. Steel conduits and fittings.—Wholesale Fittings Co. Joint boxes.—Callender's; B.I. Cables. Feeder pillars and ironclad service cut-outs.—B.I. Cables.

L.C.C.—Wiring and fittings for the installation of automatic telephone systems at the Dulwich and St. Peter's Hospitals, Whitechapel:

	£		£
Pinching and Walton. Accepted	**2,551**	Buchanan and Curwen	3,332
W. J. Furse and Co. (London) ...	3,010	Blackburn, Starling and Co. ...	3,409
Ericsson Telephones	3,035	A. Hawkins and Sons	3,650
Automatic Telephone and Electric Co.	3,125	S. Reed and Sons...	3,812
Standard Telephones and Cables	3,162	G. E. Taylor and Co.	3,839
Reliance Telephone Co.	3,190	A. Cozens	3,900

Wiring and fittings for electric lighting and power at the Lamorbey Children's Home, Sidcup:

	£		£
Holliday and Son (Electrical). Accepted	**3,685**	Electrical Installations	4,533
A. Hawkins and Sons	4,150	A. Cozens	4,690
G. E. Thomas and Co.	4,167	Pinching and Walton	4,986
A. Meckhonik	4,181	T. Clarke and Co....	5,109
Malcolm and Allan (London) ...	4,311	Berkeley Electrical Engg. Co. ...	5,211
S. Reed and Sons...	4,325	B. French	5,284
		H. J. Cash and Co.	5,298

HAMMERSMITH.—Electricity Committee. Two 1,000-kVA three-phase transformers to deal with the increasing demand at Olympia:

	£		£
Bryce, Ltd.	430 each	Ferranti, Ltd.	514 „
Yorkshire Electric Transformer Co....	450 „	C. A. Parsons & Co. ...	514 „
General Electric Co. Recommended	**514** „	Fuller Electrical & Manufg. Co.	514 „
Foster Engineering Co. ...	514 „	Bruce Peebles	514 „
Hackbridge Electric Construction Co.	514 „	Met.-Vick. Elecl. Co. ...	522 „
Johnson & Phillips	514 „	English Electric Co. ...	522 „
British Electric Transformer Co....	514 „	Brush Electrical Engg. Co....	528 „
		Electric Construction Co. ...	530 „
		British Thomson-Houston Co....	547 „

Middlesex.—The Health Committee has now accepted the tender of Messrs. Pickerings, Ltd., at £3,163 for the installation of lifts at Redhill Hospital, also tenders for equipment at the West Middlesex County Hospital as follows: Two sets of emergency lighting equipment (£115).—Chloride Electrical Storage Co. Two operating theatre lamps (£170).—Carl Zeiss (London). Electric lighting and lamps (£108).—G. A. Weston.

Sewerage Committee. Accepted. Electric floor scrubber (£142).—Mosers, Ltd.

Newburgh.—Town Council. Accepted. Electrical work at twenty-eight houses (£297).—A. G. Rutherford.

Sheffield.—Corporation. Accepted. Metering equipment (£1,133).—Ferranti, Ltd. Three 11-kV switches (£811) and 11-kV switchgear (£1,766).—A. Reyrolle & Co. Scott-connected transformer and switchgear (£400).—Met.-Vick. Elecl. Co.

Stoke-on-Trent.—Electricity Committee. Accepted. Overhead house-to-house services.—E. Holloway. Mains and cables.—Callender's. Static transformers.—Met.-Vick. Elecl. Co.

Tynemouth.—Town Council. Accepted. Cables (£3,500).—B.I. Cables.

Forthcoming Events

Institution of Electrical Engineers.—Thursday, March 11th. Institution, London, W.C.2. 6 p.m. "Modern Factors Affecting Electricity Costs and Charges." Mr. J. A. Sumner.

Meter and Instrument Section.—Friday, March 5th. Institution, London, W.C.2. 7 p.m. "Metering of Mercury-arc Rectifier Supplies and Outputs." Dr. C. Dannatt.

North Midland Centre.—Friday, March 5th. Hotel Metropole, Leeds. 7 for 7.30 p.m. Annual dinner.

North Eastern Centre.—Monday, March 8th. Armstrong College, Newcastle-upon-Tyne. 6.15 p.m. "Jointing and Terminating of High-voltage Cables." Mr. W. Holttum.

South Midland Centre.—Monday, March 8th. James Watt Memorial Institute, Birmingham. 7 p.m. "Fire Precautions in Major Electrical Stations." Mr. F. C. Winfield.

Western Centre.—Monday, March 8th. Merchant Venturers' Technical College, Bristol. 6 p.m. "Lightning." Mr. B. L. Goodlet.

Scottish Centre.—Tuesday, March 9th. 39, Elmbank Crescent, Glasgow. 7.30 p.m. "Continuous Extrusion of Lead Cable-sheaths." Dr. P. Dunsheath.

Transmission Section.—Wednesday, March 10th. Institution, London, W.C.2. 6 p.m. "Gas-impregnated Cable." Mr. A. N. Arman.

Birmingham Electric Club.—Friday, March 5th. Grand Hotel, Birmingham. 6.30 for 6.50 p.m. Annual dinner.

Electrical Development Association (*Mid-East Area*).—Wednesday, March 10th. Leeds. Annual meeting and luncheon.

Northern Counties Area.—Thursday, March 11th. Newcastle-upon-Tyne. Annual meeting and luncheon.

Scottish Area.—Friday, March 12th. Glasgow. Annual meeting and luncheon.

Institute of Transport.—Monday, March 8th. Institution of Electrical Engineers, London, W.C.2. 5.30 p.m. "Notes on Commercial and Operating Aspects of Trolley-bus Operation." Mr. T. E. Thomas.

Association of Supervising Electrical Engineers.—Tuesday, March 9th. College of Technology, Manchester. 7.15 p.m. "Compulsory Wiring Regulations and Registration." Mr. S. B. Donkin.

Illuminating Engineering Society.—Tuesday, March 9th. Institution of Mechanical Engineers, London, S.W.1. 7 p.m. "Some Aspects of the Street Lighting Problem." Mr. S. English. "The Representation of Lantern Characteristics." Mr. R. Maxted.

Batti-Wallahs' Society.—Wednesday, March 10th. Hotel Victoria, London, W.C.2. 12.50 p.m. Luncheon.

Institute of Metals.—Wednesday and Thursday, March 10th and 11th. Institution of Mechanical Engineers, London, S.W.1. Annual meeting. Wednesday, March 10th. Trocadero Restaurant, London, W.1. 7 for 7.15 p.m. Annual dinner.

Notes

Mr. Parkinson and E.I.B.A.

We are asked to announce that tickets are now available (ten shillings each) for the annual luncheon of the Electrical Industries Benevolent Association which takes place at the Savoy Hotel on Friday, April 9th, at 1 o'clock. It is hoped that there will be a good attendance of electrical people at this function as Mr. Frank Parkinson, M.I.E.E., the president-elect, is expected to outline some proposals that he has in mind for increasing the funds of the organisation. The merits of the Association hardly need any new words of praise from us at this juncture, but we hope that the many readers of the REVIEW who have the interests of the movement at heart will send in their applications and cheques for tickets promptly to Mr. A. Hugh Seabrook, the Executive Officer, at 6, Southampton Street, Holborn, London, W.C.1.

Mr. Seabrook wishes to express his thanks to the Cocktailers, "whoever they may be and wherever they may be," for their kindly thought at the British Industries Fair and for their donation to E.I.B.A.

I.E.E. Transmission Section

The Transmission Section of the Institution of Electrical Engineers is arranging an afternoon visit to the Willesden switchgear works of the British Thomson-Houston Co., Ltd., on March 17th. Beside the tour of the works and a demonstration in the high-voltage test-room, there will be special exhibits of transmission equipment and tea will be served at the works. The one-day summer visit of this Section will be to the Gravesend works of W. T. Henley's Telegraph Works Co., Ltd., on May 1st. The Section is also arranging a week-end visit to Holland on June 19th and 20th.

Railway Signalling Symbols

British standard railway signalling symbols, Part I Schematic Symbols (No. 376-Part-I-1937) have just been revised. The general modification has been in the arrangement of the symbols for colour-light signals, but there have also been additions and some modifications in the other sections. Copies of the revised Specification can be obtained from the Publications Department, British Standards Institution, 28, Victoria Street, London, S.W.1, price 2s. 2d. post free.

A French Lighting Congress

The Association of Illuminating Engineers (France) informs us that on the occasion of the 1937 Paris International Exposition an International Congress devoted to lighting applications will take place in Paris between June 24th and July 1st. Those wishing to participate or to obtain the Congress regulations should write to the organiser of the International Congress of Lighting Applications, Paris 1937, 12, Place de Laborde, Paris, 8.

A Washing Machine Transaction

At Bradford County Court on February 26th the Electrical Manufacturers Finance Co., Ltd., London, sued Ernest Ingham, Farsley, Leeds, for £2 11s., alleged arrears under a hire-purchase agreement. Defendant stated that a salesman told him that he was signing an agreement to keep an electrical washing machine on trial for a month, whereas in reality he was signing for the purchase of the machine. He signed the agreement to get rid of the salespeople.

The salesman said that when he went with his wife to defendant's house he read certain clauses of the agreement and lent Ingham 17s. to pay the deposit. Judge Frankland said he believed Ingham had been the victim of fraud. The signature was therefore not in any way binding, and he gave judgment, with costs, for the defendant.

Appointments Vacant

Engineering and electrical draughtsmen in the Admiralty and at H.M. Dockyards.

Inspector of Machinery for the Mines Department of the Gold Coast.

Instrument makers and instrument makers' improvers in the wireless workshops, New Scotland Yard.

Junior assistant development engineer for Brighton Electricity undertaking.

Deputy mains engineer and technical assistant for Cheltenham electricity undertaking.

Mains assistant for Bridlington Corporation.

Assistant mains engineer for Bath Electricity Department.

(See our classified advertisements.)

Our Service Department

EVERY day inquiries of all kinds are received by the Editors, the bulk of them relating to the producers of specified classes of electrical goods. We are able to reply to most of these with the aid of our extensive records, but in a few cases we have to seek the assistance of our readers. This week we have been asked for the names and addresses of manufacturers of the following:—

Continuity tester marked 1—M6304.

TELENERG system of remote indication.

Readers should enclose stamped addressed envelopes when making their inquiries.

Our Personal Column

Electrical men are invited to keep readers of the "Electrical Review" posted concerning their movements

Mr. L. Howles, of the South Wales Electric Power Co., was elected chairman for the coming year of the South-West England and South Wales (Northern) Area of E.D.A. at a meeting of the Area Executive Committee held on February 24th.

Mr. George Ellison, governing director of George Ellison, Ltd., has been elected a life member of the Court of Governors of Birmingham University.

Mr. P. L. Edwards, of the British Thomson-Houston Co., was elected president, and Mr. T. J. Gallagher, of Gallagher Brothers, vice-president, for the present year at the first meeting of the newly elected executive council of the Society of Irish Electrical Traders.

Mr. T. Kirkham, managing director of Ericsson Telephones, Ltd., has been elected chairman of the Telephone Development Association in succession to Col. Sir Thomas Purves.

Mr. E. Griffiths, who has been an assistant in the sales and installation section of the Gellygaer Urban District Council Electricity Department at the Bargoed showrooms, has been appointed to the staff of the Cardiff branch of the General Electric Co., Ltd.

Councillor H. Leason, manager of Robinson and Hands Electric Co., Ltd., and chairman of the Stoke-on-Trent City Electricity Committee, has been appointed a representative of the City Council on the North West Midlands Joint Electricity Authority for the next three years.

Mr. W. V. Edwards, engineer and manager of the Hastings (Sussex) Tramways Co., who has retired after many years' service, has been presented with a grandmother clock by the staff and employés, and Mrs. Edwards has been given a handbag. The presentation was made by the oldest employé, Mr. Vidler.

Mr. H. Sutherland, of Port Sunlight, who for fourteen years has been with British Insulated Cables, Ltd., recently sailed for Cape Town, *en route* for Johannesburg, to take up an appointment with an electrical engineering firm in Johannesburg.

Mr. A. T. Priddle, traction engineer to the Associated Equipment Co., Ltd., sailed on Wednesday last on the *Queen Mary* for New York, and will go from there to Montreal, where he will be present when the seven A.E.C.-English Electric, six-wheel, rear control trolley-buses, order by the Montreal Tramways Co., are officially placed in service. Mr. Priddle will also visit Winnepeg, Quebec, and other Canadian cities, returning to England in about five weeks' time.

Dr. James Gray, F.R.S., M.A., Fellow of King's College, who has been elected to the Professorship of Zoology, is the son of Mr. James Gray, managing director of the Electric Construction Co.

Mr. P. Williams has been appointed a director of Gabriel, Wade and English, Ltd.

Dr. S. English has been nominated for the presidency of the Illuminating Engineering Society for the session 1937-38.

Mr. H. Bell, O.B.E., T.D., electrical engineer and manager of the Glasgow Corporation electricity undertaking, has been nominated for the chairmanship of the Scottish Centre of the Institution of Electrical Engineers for the session 1937-38.

Mr. P. S. Grobler, electrical engineer of Lichtenburg, Western Transvaal, has resigned.

Obituary

Mr. F. B. Aspinall.—We regret to report the death of Mr. Frank Boulton Aspinall, M.I.E.E., which occurred suddenly on March 1st. Mr. Aspinall joined the City of London Electric Lighting Co., Ltd., in September, 1891, and retired from that company's service in December, 1932. He received his training at the Finsbury Technical College and subsequently spent some time with Siemens Bros., Ltd., of Woolwich. His early career with the City of London Co. was as resident engineer at the Woolquay generating station; later he became superintendent of the company's transformer stations and public lighting.

Mr. A. J. Kips.—We regret to record the death of Mr. Arthur J. Kips, late of W. T. Henley's Telegraph Works Co., Ltd., which occurred suddenly on February 20th following an operation. He was in his sixty-eighth year. Mr. Kips was a well-known figure in electric cable circles, having been one of Henley's London representatives for thirty years, prior to his retirement in July, 1934. The interment at Willesden New Cemetery on February 25th was attended by many old colleagues and business associates, among whom were Messrs. H. C. Norman, F. H. Page, W. R. Baxter, R. D. Benjamin and D. G. Evans, all London representatives of Henley's, and the members of the Argosy Lodge of Freemasons, No. 5181, of which Mr. Kips was a founder.

Mr. G. A. Harvey.—The death occurred on February 25th, at the age of eighty-four, of Mr. George Alfred Harvey, founder and chairman of G. A. Harvey & Co. (London), Ltd.

Mr. P. A. Lang.—We regret to announce the death on February 25th of Mr. Philip A. Lang at the age of eighty. Mr. Lang, who was of German origin, in early life migrated to the U.S.A., and in the 'eighties of last century had risen to the position of head of the Detail Department of the Westinghouse Electric & Manufacturing Co. Subsequently he became superintendent of the shops at East Pittsburg. In the early part of 1906 he came to this country as acting general manager of the Trafford Park Works of the British Westinghouse Electric & Manufacturing Co., Ltd., and in the same year he was confirmed in the post of general manager. He may be said truly to have been the founder of the now well-established social life of the Metropolitan-Vickers Electrical Co., Ltd. (the successor to the British Westinghouse Electrical & Manufacturing Co., Ltd.). In September, 1913, he was made managing director of the company, a position which he held until his resignation in February, 1918. He remained, however, in an advisory capacity in London to give the board the benefit of his experience until 1921. After his retirement, however, his contact with the Metropolitan-Vickers Electrical Co. was still maintained, and he continued in touch with the management until quite recently. The funeral took place at Golders Green Crematorium on March 1st, and was attended by several directors of the Metropolitan-Vickers Co. and some of the older employés who had been in direct touch with him during his period of office at Trafford Park.

The late Mr. P. A. Lang

Mr. W. Taylor, F.R.S., whose death occurred on Sunday last during a blizzard in Leicestershire, was an inventor and maker of improvements in scientific instruments. Born in 1865, he was educated at Finsbury Technical College, and when Armstrong, Ayrton & Perry invented the ammeter Mr. Taylor made the model, which is now in South Kensington Museum. He was a past-president of the Institution of Mechanical Engineers and a member of the Council of the National Physical Laboratory. He was elected a Fellow of the Royal Society in 1934.

Mr. P. B. Shaw.—The death is recorded in the *Electrical World* of Mr. Philips B. Shaw, a former associate of Thomas A. Edison, which occurred in Philadelphia on January 31st in his ninetieth year. During his association with Mr. Edison Mr. Shaw organised and directed the financing of many electric light and power plants in Pennsylvania.

Mr. J. Newlands.—The death is announced at the age of eighty of Mr. John Newlands, C.T.E., C.B.E., Controller of the Central Telegraph Office of the G.P.O. from 1910 to 1919.

Will.—Mr. B. P. Scattergood, F.S.A., M.I.E.E., of Harpenden, left £13,649, with net personalty £6,453.

Precision Photometry

A meeting of the Photometric Section of the Illuminating Engineering Society was held on February 22nd in the General Electric Company's research laboratories at Wembley. A lecture by Mr. G. T. Winch on "Some Practical Aspects of Precision Photometry" was illustrated by a number of effective experiments. The author showed, by the aid of a spot-light travelling on a large-size scale visible to all the audience, how slight changes in the adjustment of the photometric bench might give rise to quite appreciable errors. One factor studied was the effect of screens to prevent stray light affecting the photometer. This led afterwards to a discussion on whether the walls of photometry rooms need necessarily be blackened. It was also shown how blocking even part of the glass bulb of an electric lamp might diminish the candle power owing to reflected images of the filament, even though the filament itself was unscreened. Other topics considered were the effect of imperfect screening of the photometer head and photo-cell, the effect of the size of the source of light studied, the limitations of photometric integrators and cubes, the comparative advantage of equality of vision and flicker photometers for comparing sources of light differing in colour, and the possible source of errors in direct reading physical photometers using photo-cells. The lecture was followed by a keen discussion, which was opened by Dr. J. W. T. Walsh.

Financial Section

New Companies. Official Returns of Capital. Debenture Charges. Reports of Electrical Companies. Dividend Announcements. Transactions in Stocks and Shares

New Companies Registered

Radio and Electrical Developments, Ltd.—Public company. Registered February 23rd. Nominal capital, £300,000. Objects: To acquire not less than 90 per cent. of the issued share capital of Standard Radio Relay Services, Ltd., to acquire and hold for investment purposes only stocks, shares, debentures, &c., to carry on the business of an investment trust company. The following persons have consented to be directors: F. E. Powell, 140, Park Lane, W.1; A. Miller, 37, Grosvenor Square, W.1; Sir Herbert B. Grotrian, Bt., Knolls, Leighton Buzzard, Beds; B. H. Lyon, 20, Tregunter Road, S.W.7; W. W. Wakefield, 6. St. James' Terrace, Regent's Park, N.W.; and Capt. Vernon H. Holt, Ravenswick, Kirbymoorside, Yorks (all directors of Standard Radio Relay Services, Ltd.). The amount borrowed by the directors is not to exceed by more than £100,000 the authorised share capital. Registered office: Bush House, Aldwych, W.C.2.

R. B. Pullin & Co., Ltd.—Private company. Registered February 25th. Nominal capital, £70,000. Objects: To acquire the goodwill and freehold property and other assets of the business of instrument makers carried on by Pullin Vendors, Ltd. (formerly R. B. Pullin & Co., Ltd.), at Phœnix Works, Great West Road, Brentford, and to carry on the business of manufacturers, exporters and importers of and dealers in instruments, transformers, radiators, dynamos, motors and electric power and transmission plant, &c. The directors are: R. B. Pullin and P. J. Ellis, addresses not stated. Solicitors: Godden, Holme & Ward, 34, Old Jewry, E.C.2.

R. and H. Electric, Ltd.—Private company. Registered February 25th. Capital, £2,000. Objects: To carry on business as electricians, radio and electrical engineers, &c. The subscribers are: E. Nash, 63, Wood Street, Taunton; and Mrs. E. Nash, 63, Wood Street, Taunton. E. Nash is the first director. Registered office: 63, Wood Street, Taunton.

British Wiredrawers, Ltd.—Private company. Registered February 24th. Capital, £100. Objects: To carry on the business of wire rod rollers, manufacturers and drawers of wire and special sections of round or other shape for ropes, cords, fencing, cables of all kinds, aeronautical requirements, mechanisms, tools, machines, &c. The directors are: P. L. Hunting, Flat 14, 2, Halkin Place, S.W.1, and two others. The directors may from time to time at their discretion borrow sums of money for the purpose of the company, and there shall be no limit to the amount that may be so borrowed. Registered office: "B" Floor, Milburn House, Newcastle-on-Tyne.

Combi Electric Co., Ltd.—Registered February 26th. Capital, £9,000. Objects: To carry on business as manufacturers and repairers of and dealers in electric circuit-breakers, switchgear, dynamos, motors, armatures, magnetos, batteries, &c. The directors are: C. L. Cleburne, 31, Upper Richmond Road, Putney, S.W.15, and P. F. Clark, Hurstcote, Shere, Surrey. Solicitors: Good, Good & Co., Fairfax House, Fulwood Place, High Holborn, W.C.1.

A. S. McHugh & Co., Ltd.—Private company. Registered February 27th. Capital, £7,500. Objects: To carry on the business of manufacturers of and dealers in mechanical and electrical plant, electric and other lamps and appliances, manufacturers of electrical cables, &c. The permanent directors are: A. S. McHugh, address not stated, F. T. B. Davidson, 22, Denewell Avenue, Low Fell, Co. Durham, and G. S. Smith, 21, Queen's Road, Monkseaton. Solicitors: Dees & Thompson, Newcastle-on-Tyne.

Regal Radio Co., Ltd.—Private company. Registered February 22nd. Capital, £1,000. Objects: To acquire the business of a radio and cycle stores carried on at 134, Plaistow Road, West Ham. The directors are: C. A. Robinson, 118, Caistor Park Road, E.15, and two others. Secretary: J. James. Registered office: 18, Upton Lane, Forest Gate, E.7.

Emerson Clark & Co., Ltd.—Private company. Registered February 22nd. Capital, £100. Objects: To carry on the business of an electric light company in all its branches, &c. The directors are: H. N. Jordan, 12, Portinscale Road, Putney, S.W.15; and P. E. Culverhouse, 21, The Common, Ealing, W.5. Secretary: H. N. Jordan. Registered office: 18/19, Upper Grosvenor Street, W.1.

Dynatron Radio, Ltd.—Private company. Registered February 23rd. Capital, £100. Objects: To carry on the business of manufacturers, importers and exporters of and dealers in all kinds of wireless apparatus, cabinets, loud speakers, radiogramophones, &c. The directors are: R. H. Hacker and A. G. Hacker, both of Little Gables, Ray Lea Road. Registered office: Perfecta Works, Ray Lea Road, Maidenhead, Berks.

Dyn Works, Ltd.—Private company. Registered February 23rd. Capital, £5,000. Objects: To carry on the business of electrical, mechanical and general engineers, founders, &c. The subscribers are: J. P. Graham, Hillcroft, Stocksfield-on-Tyne; and R. H. Spark, 1, St. Nicholas Buildings, Newcastle-on-Tyne. Qualification: 100 shares. Secretary: R. H. Spark. Solicitors: Keenlyside & Forster, Lloyds Bank Chambers, Collingwood Street, Newcastle-on-Tyne.

Lightning Service Radio Suppliers, Ltd.—Private company. Registered February 25th. Capital, £100. Objects: To carry on the business of manufacturers of radio apparatus and accessories, radio engineers and contractors, &c. The subscribers are: A. Veitch, The Bona, Glenleigh Park, Bexhill-on-Sea; and A. L. Youngman, 4, Haldane Road, East Ham, E.6. Registered office: 45, London Wall, E.C.2.

F. Suffield (Radio), Ltd.—Private company. Registered February 20th. Capital, £1,000. Objects: To carry on the business of manufacturers of and dealers in radio and television sets, &c. The permanent directors are: F. Suffield and I. R. Suffield, both of 191, Broad Street, Dagenham, Essex. Registered office: 191, Broad Street, Dagenham, Essex.

Magneto Service Co., Ltd.—Private company. Registered February 24th. Capital, £100. Objects: To carry on the business of manufacturers of and dealers in motor cars, electric motors, amplifiers, wireless, talking apparatus, magnetos, &c. The subscribers are: B. Playmers and S. J. Playmers, both of 69, Newington Causeway, S.E.1. B. Playmers is first director. Registered office: 69, Newington Causeway, S.E.1.

Albion Electrical Services, Ltd.—Private company. Registered February 25th. Capital, £500. Objects: To carry on the business of manufacturers of and dealers in wireless and television receivers and transmitters, radiograms and gramophones and records, electricians, &c. The subscribers are: L. W. Glyde, 17, Basinghall Street, E.C.2; and F. W. Barton, 21, Malvern Drive, Ilford, Essex. D. Langridge is the first director. Secretary: Lionel W. Clyde.

Deacons Radio, Ltd.—Private company. Registered February 4th. Capital, £1,000. Objects: To carry on the business of general merchants, electrical, mechanical and general engineers, manufacturers of and dealers in wireless, &c. M. M. Harris, 54a, George Street, Richmond, is the first director.

Wire-Less Motors, Ltd.—Private company. Registered February 5th. Capital, £100. Objects: To carry on the business of manufacturers and repairers of and dealers in electrical motors, transformers, coils, voltage control apparatus, mechanical power units, &c., advertising and publicity agents, manufacturers of and dealers in motor car lamps, accessories, &c. The directors are: A. G. de Grey, 92, Victoria Street, S.W.1, and two others. Registered office: 92, Victoria Street, S.W.1.

Coulphone Radio Mfg. Co., Ltd.—Private company. Registered February 11th. Capital, £500. Objects: To carry on the business of manufacturers of, agents for and dealers in wireless and television sets and accessories, &c. The subscribers are: C. Coulborn and Mrs. A. Coulborn, both of Ellerslea, Liverpool Road, Hutton, nr. Preston. Solicitor: John Whitehead, 2, Chapel Street, Preston.

A. & R. Littledale, Ltd.—Private company. Registered in Edinburgh February 22nd. Capital, £100. Objects: To acquire the business of A. & R. Littledale, 89, West Regent Street, Glasgow, C.2, and to carry on the business of merchants, agents for, dealers in and exporters and importers of electrical goods and apparatus, &c. The directors are: A. G. Littledale and Mrs. R. M. Littledale, both of Baillieston House, Baillieston. Registered office: 89, West Regent Street, Glasgow, C.2.

Trafalgar Electrical Machinery Co., Ltd.—Private company. Registered February 26th. Nominal capital, £1,000. Objects: To acquire the business now carried on by Trafalgar Engineering Co., Ltd. (incorporated on July 15th, 1921) and to carry on the business of general and marine engineers, manufacturers of cable-making machinery and appliances, &c. The subscribers are: E. M. Sawyer, 27, Leysdown Road, Eltham, S.E.9, E. L. Smith, 48, Ellesmere Road, Dollis Hill, N.W.10, and five others. Solicitors: Kenneth Brown, Baker, Baker, Essex House, Essex Street, W.C.2.

Autodial Accessories, Ltd.—Private company. Registered February 17th. Capital, £100. Objects: To carry on business as manufacturers of and dealers in telephonic, telegraphic and television apparatus, equipment and fittings of all kinds, &c. The subscribers are: R. L. Clarke and C. F. Gould, both of 39/40, Albemarle Street, W.1. Solicitors: Halliday, Clarke & Co., 39/40, Albemarle Street, W.1.

Latex Illuminations, Ltd.—Private company. Registered February 8th. Capital, £100. Objects: To carry on business as manufacturers of and dealers in electric lamps, electrical plant, machinery, fittings, insulators and insulating materials, and in particular to develop and exploit methods for covering and colouring lamps, &c. The directors are: W. D. Fox, 59, Acre Lane, Carshalton; and T. L. Jones, 53, Corinne Road, Tufnell Park, N.19. Registered office: 31, Farringdon Road, E.C.1.

Returns of Electrical Companies

Walsall Electrical Co., Ltd.—Capital, £3,500 in 1,500 preference and 2,000 ordinary shares of £1. Return dated October 26th, 1936. 1,170 preference and 1,560 ordinary shares taken up. £2,730 paid. Mortgages and charges nil. A return of allotments, made up to December 14th, 1936, shows a further 80 ordinary shares allotted for cash and fully called up.

Central Electrical Engineers Accessories Supply, Ltd.—The nominal capital has been increased by the addition of £900 in £1 shares beyond the registered capital of £100.

F. G. Laurie, Ltd.—The nominal capital has been increased by the addition of £1,000 in £1 ordinary shares beyond the registered capital of £1,000.

A. E. Naylor, Ltd.—W. Hand, of 12, Cherry Street, Birmingham, ceased to act as receiver and/or manager on February 10th, 1937.

Ralph Garrett, Ltd.—Satisfaction (1) to the extent of £1,000 on February 5th, 1937, of charge dated May 8th, 1935, and registered May 21st, 1935, and (2) to the extent of £500 on same date of charge dated May 9th, 1935, and registered May 31st, 1935.

Charge on 18, Ship Street, Brighton, dated February 6th, 1937, to secure £1,500. Holders: A. A. Barnes, 3, Pavilion Parade, Brighton; and W. R. Fitzhugh, Hamels, Boar's Hill, Berks.

John Dugdell & Co., Ltd.—Capital, £10,000 in £1 shares. Return dated November 30th, 1936. All shares taken up. £3 paid, £9,997 considered as paid. Mortgages and charges nil.

Battery Maintenance, Ltd.—Particulars filed of £850 debentures authorised January 21st, 1937, charged on the company's undertaking and property, including uncalled capital, the whole amount being now issued.

J. S. Peress, Ltd.—Particulars filed of £2,000 debentures, authorised January 18th, 1937, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

Muirhead & Co., Ltd.—Satisfaction to the extent of £2,500 on July 8th, 1915, of debentures authorised November 16th, 1904, and registered November 23rd, 1904. Notice filed February 19th, 1937.

Wirewell Electrical & Radio Installations, Ltd.—Satisfaction in full on January 19th, 1937, of mortgage dated October 29th, 1935, and registered October 31st, 1935. (According to the register of mortgages, the only instrument registered October 31st, 1935, was a charge which originally secured £800.)

Eureka Vacuum Cleaner Co., Ltd.—Satisfaction in full on December 21st, 1936, of debenture registered February 12th, 1932, securing £3,000.

Coates & Co. (Harrogate), Ltd.—Particulars filed of debentures for not more than £800 authorised February 12th, 1937, charged on the company's property, present and future, including uncalled capital, the amount of the present issue being £800.

Mitchell Electric Co., Ltd.—J. E. Talbot, of 5/11, Theobald's Road, W.C.1, ceased to act as receiver and/or manager on February 19th, 1937.

E. T. Turner, Ltd.—H. J. Wheldon, of 18, Broadway Chambers, The Broadway, W.6, was appointed receiver and manager on February 15th, 1937, under powers contained in debenture dated December 23rd, 1935.

Accurate Recording Instrument Co., Ltd.—C. Wakeling, of 8, Serjeant's Inn, E.C.4, ceased to act as receiver and manager on February 20th, 1937.

Simplex Conduits, Ltd.—Capital, £100,000 in £1 shares. Return dated November 10th, 1936. 90,000 shares taken up. £50,000 paid. £40,000 considered as paid. Mortgages and charges, nil.

Simplex Electric Co., Ltd.—Capital, £500 in £1 shares. Return dated November 10th, 1936. All shares taken up. £500 paid. Mortgages and charges, nil.

Tubes, Ltd.—Capital, £215,000 in £1 shares. Return dated November 13th, 1936. All shares taken up. £107,584 paid (£1 on 82,859 shares and 10s. on 49,450 shares). £107,416 considered as paid (£1 on 82,691 and 10s. on 49,450 shares). Mortgages and charges, nil.

Electric Reduction Co., Ltd.—Capital, £50,000 in 16,200 preference and 33,800 ordinary shares of £1. Return dated November 10th, 1936. 16,200 preference and 28,000 ordinary shares taken up. £18,000 paid on 13,000 preference and 5,000 ordinary shares. £27,000 considered as paid on 3,200 preference and 23,800 ordinary shares. Mortgages and charges, £25,000.

Crosland, Ltd.—Capital, £2,000 in £1 shares. Return dated October 17th, 1936. 1,002 shares taken up. £1,002 paid. Mortgages and charges, nil.

Ever Ready Electric Bulb Co., Ltd.—Capital, £10,000 in £1 shares. Return dated October 16th, 1936. 2,500 shares taken up. £2,500 paid. Mortgages and charges, nil.

H. P. Electrical Co., Ltd.—Capital, £1,000 in £1 shares. Return dated September 21st (filed December 1st.), 1936. 654 shares taken up. £654 paid. Mortgages and charges, nil.

Avenue Electric Co., Ltd.—Capital, £100 in £1 shares. Return dated August 20th, 1936. 100 shares taken up. £100 paid. Mortgages and charges, nil.

Dean & Noble, Ltd.—Capital, £1,000 in £1 shares. Return dated October 21st, 1936. All shares taken up. £1,000 considered as paid. Mortgages and charges, nil.

Beethoven Radio, Ltd.—Capital, £20,000 in £1 shares. Return dated December 28th, 1936. 1,500 shares taken up. £502 paid, £998 considered as paid. Mortgages and charges £11,940.

Northern Electrical Company (Grimsby), Ltd.—Capital, £8,000 in 8,000 shares of £1. Return dated November 26th, 1936. 7,249 shares taken up. £7,249 paid. Mortgages and charges nil.

"Trade" Signs, Ltd.—Capital, £100 in £1 shares. Return dated October 14th, 1936. Two shares taken up. £2 paid. Mortgages and charges nil.

G. A. Nicholas, Ltd.—Capital, £2,000 in £1 shares. Return dated November 4th, 1936. 1,450 shares taken up. £1,450 paid. Mortgages and charges nil.

Devereux, Moodie & Co., Ltd.—Capital, £5,000 in 2,500 preference and 2,500 ordinary shares of £1. Return dated January 14th, 1937. 1,900 preference and 1,001 ordinary shares taken up. £2,901 paid. Mortgages and charges nil.

Polchar's Wireless, Ltd.—The nominal capital has been increased by the addition of £1,750 in £1 ordinary shares beyond the registered capital of £250.

Wilkinson, Bentley & Co., Ltd.—Capital, £3,000 in £1 shares. Return dated November 11th, 1936. 1,850 shares taken up. £1,850 paid. Mortgages and charges, nil.

Coventry Radio Relays, Ltd.—Capital, £10,000 in 6,750 preference shares of 2s. and 186,500 ordinary shares of 1s. Return dated November 9th, 1936. 6,750 preference and 200 ordinary shares taken up. £675 7s. paid on 6,750 preference and seven ordinary shares, £9 13s. considered as paid on 193 ordinary shares. Mortgages and charges nil.

Inventum Electrical Appliances, Ltd.—Capital, £500 in £1 shares. Return dated January 13th, 1937. 52 shares taken up. £52 paid. Mortgages and charges nil.

Private Telephone & Electric Co., Ltd.—Debenture, charged on the company's undertaking and property, present and future, including uncalled capital, dated February 11th, 1937, to secure £300. Holder: Mrs. M. B. Atkinson, 18, Parkfield Road, Worthing.

City Notes

The Midland Counties Electric Supply Co., Ltd., held its annual meeting on Wednesday last, when Mr. G. Balfour (chairman), who presided, said that in the past year business had been satisfactory in all departments. They had again extended their electrical services and reduced charges in many districts, while the merger of the Leamington and Warwick electricity supply undertakings would enable them to modernise that system. Recently they had concluded the purchase of the Tamworth District Electric Supply Co.'s undertaking. Progress had been made with the installation of the additional 30,000-kW turbo-generator and boiler plant at the Spondon power station, and this would be ready for operation in the near future. With this additional plant the total installed capacity in their three stations would amount to 150,000 kW. The maximum demand during the year was 109,200 kW, of which 13,090 kW was a superimposed coincident maximum demand on the Spondon station made by the Central Electricity Board. Total sales were 363,000,000 kWh, compared with 324,000,000 kWh for 1935; the export to the Central Board being 98,500,000 kWh. The consumers connected in 1936 totalled 15,972 against 16,734 in the preceding year, making the total connected at the end of the year 108,266. It was to be noted that in four years they had more than doubled the number of consumers. With regard to transmission lines and distribution cables they had in service 1,516 miles of high-voltage cables and 1,746 miles of low-voltage lines, while sub-stations installed had risen to 1,075, in addition to those on consumers' premises. Street lighting was now provided in two boroughs, sixteen urban districts, and 124 rural parishes, while during the year their services were carried into twenty-seven parishes hitherto unserved and they now supplied three boroughs, thirty-one urban districts and 549 parishes. Reductions in electricity charges operating as from June 30th last had lowered bulk supply charges to local authorities to the extent of £25,600 and domestic supply charges by £26,200 for the half-year. Furthermore, industrial consumers had benefited by £24,450 by waiving increased charges payable under the coal clause.

The Northampton Electric Light & Power Co., Ltd.—Presiding at the annual meeting held on Monday last, Mr. F. H. Thornton (chairman) said that the total output from the generating station during 1936 was 116,000,000 kWh, an increase of 18,500,000 kWh or 19 per cent. over 1935, and the whole of this was sold to the Central Electricity Board, 85,000,000 kWh being repurchased for the company's system. Sales to consumers and associated companies rose by 10 million kWh to 75 million kWh, an increase of 14½ per cent.; this was partly due to continued improvement in trade and a steady rise in the number of consumers connected, which was now 42,500, an increase of 4,000 during the year. Capital expenditure continued to be heavy, and £142,000 was spent during the year after allowing for £30,000 written off. Half of this amount represented payments for the new generating station extensions. E.h.v. mains had been extended by fifteen miles, making a total of 566 miles, while twenty-four miles of low-voltage mains had been added, making a total of 414 miles, and six more villages were connected to their system. The new 30,000-kW turbo-alternator and auxiliary plant extensions were completed and in operation in April, 1935, and had resulted in an appreciable coal economy. Substantial tariff reductions had been made during the five years to 1934, their cumulative effect amounting in 1934 to over £43,000, but since that date their generating station had become a selected station, and the economies predicted by the Central Board had not materialised. Consequently, they had been unable to make any substantial tariff reductions in the past two years. Difficulty in obtaining adequate coal supplies still continued; their reserve stock was insufficient, and in case of emergency the responsibility for shortage must fall on other shoulders.

The Bristol Tramways and Carriage Co., Ltd., held its annual meeting on February 24th, when Mr. J. F. Heaton (chairman), who presided, said that considerable progress had been made in the negotiations with the Bristol Corporation. The proposed agreement provided for the sale to the Corporation of the company's statutory undertaking, i.e., the tramways undertaking, for the sum of £1,125,000, to be taken either in cash or Bristol Corporation stock. There would be a scheme of co-ordination by which the tramways undertaking and the company's city omnibus undertaking would be operated together as a single unit, the net surplus of revenue being divided equally between the two parties. The company had acquired a controlling interest in the Bath Electric Tramways, Ltd., and the Bath Tramways Motor Co., Ltd., and negotiations had been successfully concluded with the Gloucester Corporation whereby the company acquired for cash from the Corporation the rolling stock and other tangible assets of its omnibus undertaking, and at the same time entered into a working arrangement under which the company would operate the local services in co-ordination with the services in the surrounding area. The agreement was for twenty-one years, the Corporation receiving a fixed annual sum together with a share in any net surplus there might be. They had also acquired the goodwill or running rights in Weston-super-Mare of the tramways of the Weston-super-Mare and District Electric Supply Co., Ltd. It was intended to scrap the trams and merge and co-ordinate the business with that of their company.

The Electrical Distribution of Yorkshire, Ltd., reports a profit for 1935 of £218,906, as compared with £192,606 for 1935, which with £42,237 brought in, makes £261,143 available. The final dividend on the ordinary stock is 4½ per cent., making 9 per cent. for the year, less tax. Depreciation and reserve fund receives £70,000, and £56,181 is carried forward. The sales of electricity increased from 42,748,316 kWh to 48,591,730 kWh, and the number of consumers connected from 82,675 to 93,161. The report states that increased sales of electricity and steady progress are recorded by the subsidiary companies in Cumberland. The capital of the company was increased during the year to £3,200,000 by the creation of 1,000,000 new shares of £1 each, which the directors may issue either as ordinary or preference shares. An issue has been made of 500,000 6 per cent., cumulative preference shares by the provisional allot-

ment to ordinary stockholders of one preference share for each £3 of ordinary stock held. The whole issue has been taken up and the new preference shares will be converted into stock. Meeting: March 8th.

The Mid-Southern Utility Co.—Presiding at the annual meeting held on February 25th Mr. R. W. Edwards (chairman) said that the net increase in sales of electricity during 1936, as compared with 1935, represented 39.5 per cent., excluding consumption on the company's various works and subsidiary undertakings. The low tariffs for purposes other than lighting led to an extended use of electrical apparatus, which was offered on easy terms, and this increased the load by 19,819 kW, as against 7,079 kW in the previous year.

Hall Telephone Accessories (1928), Ltd., held its annual meeting on February 25th, when Major O. M. Guest, M.P. (chairman), who presided, said that during 1936 they had increased the number of their customers. They had obtained contracts from the Air Ministry, which had expanded the field of their activities, as well as the orders for their standard machines for the General Post Office, which they undertook last year and still continued. Their enlarged works had enabled them to handle the 1936 turnover, and the latest additions which should be ready and in use by the end of February would allow space for further work. The order book was heavier than in the corresponding period of last year, but they were still in a position to deal with further orders.

The North West Midlands Joint Electricity Authority.—Particulars were published on February 25th for information only of an issue of £250,000 3 per cent. stock which has been placed privately at 94½ per cent. The stock will carry interest from March 1st, and a first payment calculated from that date will be paid on July 1st. The proceeds of the issue will be utilised to finance the general development of electricity supply and to repay temporary borrowings effected for that purpose. The whole of the expenditure covered by the proposed issue has been sanctioned by the Electricity Commissioners. An annual sinking fund will be established sufficient to redeem the stock in 1957 at par.

Enfield Cable Works, Ltd., reports a profit for the year ended December 31st of £227,706, as compared with £143,357 in the preceding year, which with £29,906 brought in makes £257,612. After deducting directors' fees and depreciation, it is proposed to pay a final ordinary dividend of 15 per cent., maintaining the distribution for the year at 25 per cent., but on larger capital. Reserve receives £80,000, and taxation reserve £5,000, the balance carried forward being £14,737. Meeting: March 15th.

The London Electric Supply Corporation, Ltd., held its annual meeting on March 2nd, when Mr. O. R. H. Bury (chairman), who presided, said that the number of kWh sold during the year was 367,224,832, an increase of 24 million kWh, as compared with 1935, or 7 per cent. A gratifying feature of the increase was reflected in the kWh sold for power and industrial purposes. The year had been a record for the company in revenue, in kWh sold, and in the number of consumers connected. There had been a slight increase in the price paid for each kWh, chiefly on account of the higher cost of coal. Approximately thirty-five miles of new mains were laid during the year, bringing the total up to 378 miles. The all-in domestic business tariffs continued to progress, the number of electric cookers and water-heaters connected to the mains in 1936 being greater than in any previous year. The assisted wiring scheme introduced in 1933 had proved attractive, and during the year 1,100 consumers had installations under this scheme. Since the all-in domestic tariff had been introduced the average consumption of this class of consumer had increased sixfold.

The Notting Hill Electric Lighting Co., Ltd.—Presiding at the annual meeting held on Tuesday last Mr. G. Balfour (chairman) mentioned that the ordinary shares of the company were taken over by the Metropolitan Electric Supply Co. in April last year. That company had prepared a scheme which was being put into effect to improve the efficiency of both the a.c. and d.c. systems. A new showroom and demonstration room had been provided and weekly demonstrations of domestic electrical appliances had resulted in 330 cookers and 125 water-heaters being let out on hire during the year. The connected load increased by 4,416 kVA, bringing the total to 33,045 kVA. The number of consumers increased by 2,274 to 18,559, the sales being 18,500,000 kWh, an increase of 13.6 per cent. It was anticipated that the rate of progress shown last year would be maintained if not increased during the current year, as several blocks of flats were in course of construction and other new buildings were contemplated in their area of supply.

The Richmond (Surrey) Electric Light & Power Co. is paying a final dividend of 4 per cent., less tax, making 7 per cent. (against 6½ per cent.).

The Bournemouth & Poole Electricity Supply Co. is paying a final dividend of 9 per cent., less tax, maintaining the distribution for the year at 15 per cent.

The Oxford Electric Co. announces a dividend of 6 per cent. for the year (against 7 per cent.).

The Metropolitan Electric Supply Co. has declared a final ordinary dividend of 7 per cent., making 10 per cent. for the year (same). It is also proposed to pay a special bonus of 2½ per cent., tax free, to mark the jubilee year of the company.

The North Metropolitan Electric Power Supply Co. is paying a final dividend of 6 per cent. on the ordinary stock, making 10 per cent. for the year (same). Only the final dividend of 6 per cent. was paid in respect of 1935 on the £678,737 ordinary stock issued in July, 1935. The dividend for 1936 therefore requires an additional £27,150. Depreciation and reserve account receives £337,352 and contingency account £30,000. The amount carried forward is £63,665, against £49,861 brought in.

Newman Industries, Ltd., in its first report for 1936, shows a profit of £26,297, after charging depreciation, of which £3,955 has been transferred to capital reserve in respect of profits earned prior to incorporation. The initial ordinary dividend is at the rate of 17 per cent. per annum for the period April 3rd to December 31st. It is proposed to write off the balance of the preliminary expenses (£1,189), to transfer £3,000 to tax reserve and £7,500 to general reserve, and to carry forward £2,246.

The South Wales Electric Power Co. held an extraordinary meeting on Monday last at which a resolution was passed authorising an increase in capital of £200,000 by the creation and issue of new ordinary stock entitled to the same privileges as the existing ordinary stock.

The Telegraph Construction & Maintenance Co., Ltd., reports a net profit for 1936 of £29,115, as against £432 in 1935. To this is added £30,385 brought in, and after paying a dividend of 7½ per cent. (the first since 1930) the balance carried forward is £31,488. The report states that business has shown a marked improvement in all branches. Meeting: March 9th.

The Lancashire Dynamo & Crypto, Ltd., proposes to pay a final dividend of 15 per cent., less tax, making 20 per cent. for the year. For the previous year the dividend was 10 per cent., on £260,000 of ordinary capital. Some of the financial particulars of the amalgamation of this company and the Foster Engineering Co. appear in our "Business Notices" to-day.

The Cables Investment Trust, Ltd., has declared an interim dividend of 2 per cent., less tax, on the ordinary stock. For the initial period of 11½ months to June 30th, 1936, the dividend was 1½ per cent.

Ward & Goldstone, Ltd., are paying the usual final dividend for the year on the cumulative preference shares at the rate of 7 per cent. per annum.

The Newcastle & District Electric Lighting Co., Ltd., has declared a dividend at the rate of 7 per cent. on the ordinary shares for 1936.

The Llanelly and District Electric Supply Co. is paying an ordinary dividend of 5½ per cent., less tax, for 1936 (against 5 per cent.).

Clarke, Chapman & Co. have announced a dividend of 8 per cent. on the ordinary shares for 1936, less tax, against 6 per cent. for 1935.

Crabtree Electrical Industries, Ltd., announces an interim dividend of 5 per cent., actual, on the ordinary shares.

The Mersey Power Co. proposes to pay a dividend of 7½ per cent. on the ordinary shares for 1936 (against 7 per cent.).

The Western Electricity Supply Co. is paying an interim dividend of 4 per cent. (same).

Stocks and Shares

TUESDAY EVENING.

CONSIDERABLE progress has been made along the path of recovery in the prices of gilt-edged stocks and shares compared with those of a fortnight ago. The markets of to-day show a degree of firmness which might be deemed remarkable if it were not for the assurance of the Government that the enormous amount required for the purpose of the Defence Loan is not likely to come into immediate competition with the securities at present existing. Removal of this apprehension led to a sharp advance in values, and in this improvement the majority of investment markets participated.

On Monday in this week a number of the ordinary shares in the electricity supply list were quoted ex dividend. In the result, no particular change occurred in prices, allowing for the deductions. There is, however, more stock available at present in this department than has been the case for some time past. At current quotations the yield on the money, instead of being a little under 3¾ per cent., as it was for some months, is now nearer 4 per cent.

Central Electricity issues are easier on the whole, in spite of the rally in other gilt-edged stock. One or two speakers have lately indulged in caustic remarks at the expense of the Board, and of the extra expense to which, according to the critics, the customers are put by reason of the grid. London Electric Transport 2½ per cents. are down 2 points at 88½. London Passenger Transport stocks are steady. Various gilt-edged preference shares in the industrial groups are marked down. No better illustration of the change in current financial conditions can be cited than the state of neglect into which preference shares have temporarily subsided.

Electricity Supply and Equipment

Last month's slide in home electricity supply shares took the average yields on ordinary shares in this group to a fraction over the 4 per cent. mark. Now that War Loan is shying from the 3½ per cent. yield basis to which a fall seemed at one time possible, investors are paying greater attention to the electricity supply market's season of dividends and reports. Most of the news is of an encouraging order, and has brought in some steady buying of shares at the lower levels. Anything startling in the way of dividends is not of course expected. The North-Eastern payment of 7 per cent. was, nevertheless, 1 per cent. up on that of the previous year. Midland Counties is paying slightly more at 8 per cent. The latter company is proposing a capital increase in which ordinary shareholders can reasonably look to be offered participation on favourable terms. Other companies, including Lancashire Electric and Yorkshire Electric, are also likely to be in the capital market before long. Reports issued during the past week or two show, without important exception, steady—in some cases substantial—increases in output and revenue. The falls in prices that occurred in February have been almost recovered in March.

With prices recovering in the gilt-edged market, people are less disposed to contemplate the modesty of yields on their holdings of the so-called gilt-edged industrial equities. Attention is being switched back to the prospect of general indus-

trial expansion under the influence of normal plus armament business. Leading ordinary shares in the electrical equipment market, which has lately proved itself vulnerable to conditions in the fixed-interest sphere, are mostly on the up-grade; prices have recovered a fair proportion of the set-back. Bullish factors are plentiful at the present time, outstandingly good results have come in quick succession from such companies as Telegraph Construction, English Electric, Hall Telephone, Enfield Cable and Lancashire Dynamo. Among shares to take a prominent part in the past week's price recovery were Associated Electrical, which are now 56s. after having fallen to nearly 50s. Cable shares generally picked up a part of recent losses. British Insulated rose 7s. 6d., but are still some way below their recent best. Siemens gained ½, to 1⅛, and Telegraph Constructions at 40s. ex dividend are approximately 8s. 9d. up on the last fortnight. The rise in Brush, now over 60, has attained almost spectacular proportions. The brighter atmosphere is reflected in Crompton Parkinsons at 72s. 6d., and in numerous other members of the group. Crabtrees eased off to 34s. on the declaration of a 5 per cent. interim dividend.

Lancashire Dynamo and Enfield Cable

Inklings of impending developments have, in the past uncertain weeks, kept Lancashire Dynamos and Crypto shares moving fairly strongly against an adverse tide. The price was 67s. 6d. a month ago and is now 78s. 9d. ex dividend, having crowned a steady rise with a jump of nearly 5s. on news that the ordinary dividend is to be double last year's distribution of 10 per cent. The yield on the new dividend works out at £5 1s. 6d. per cent., which looks well in comparison with others in the list. Terms of the proposed new capital issue have not yet been made known; it is thought, however, that they are likely to present shareholders with something fairly substantial in the way of "rights." An offer of shares at 60s., on a one-in-three basis, is suggested.

Disappointment at the absence of an increase in the Enfield Cable dividend was partially offset by disclosure in the accounts of a considerable rise in earnings. Encouragement is drawn from the fact that, although this year's dividend is being paid on capital increased, since last year, by a 25 per cent. capital bonus, it has been possible to place a much higher sum to reserves. The latter's impressive proportions lead some people to look for another free distribution of scrip, sooner or later.

English Electric

English Electric issues came into further demand on the confident tone of the annual meeting. Previously, the prices had risen in response to the big improvement shown by the past year's result, and they were well supported during the market's recent weak spell. The ordinary have appreciated to 34s.; the preference stand at 26s. It was pointed out in the report that in a normal year unencumbered with arrears of fixed-interest charges last year's profits would have been equivalent to more than 11 per cent. on the ordinary capital. As things were, it was possible to bring preference dividends fully up to date, and to put the ordinary shares at scratch for participation in future profits. On the official view of further progression in the current period, holders of the ordinary seem to be assured of a dividend in twelve months' time. The last payment was 5 per cent. in respect of 1924.

Cable and Wireless

Hopes of sustained improvement in international trading relationships are responsible for firmness in telegraph stocks as a whole. Cable and Wireless issues have received a special stimulus in the shape of rising monthly traffic indices, the last three having been particularly good. The Combine's preference stock is firm at 109¾, but optimism is, at the moment, finding its chief expression in buying of the ordinary stocks. During the past week the "A" ordinary has risen from 26½ to 29½ and the "B" from 8⅛ to 10. Talk of early financial developments grows in persistency. Western Unions have put on 2 points, to 77½, and American "Tel. and Tel." 3½ points, to 181½. Internationals are firm at 14⅞. The market is inclined to revise earlier estimates of a 10 per cent. dividend this year on Marconi Marines: repetition of the previous rate of 7½ per cent. is now regarded as more likely.

Baird Television deferred are dull at 1s. 3d. and the preferred at 2s. 9d. E.M.I. shares show no change at 24s. 3d.

Miscellaneous Matters

The Mersey Power Company, which has, contrary to expectation, made a slight increase to 7½ per cent. in this year's dividend, is controlled by Salt Union, Ltd. A line of shares acquired from the controlling company was recently marketed; these shares are quoted at 34s., ex dividend, to yield, on the increased dividend, £4 8s. 3d. per cent. For 1934 the dividend was 6 per cent.

Business began last week in a privately placed £250,000 issue of North-West Midlands Joint Electricity Authority 3 per cent. stock. Dealings are taking place at around 96.

The iron and steel market is moving in irregular fashion. Babcocks drooped to 51s. 3d. Vickers have gone back to 35s. 9d. The rubber share market has taken on a new lease of life: prices are mostly better in sympathy with a rise in the produce. Brazilian Tractions continue their advance. The drop in British Electric Traction deferred stock has been checked, and a few buying orders lifted the price to 1550, a gain on the week of 75 points.

Share List of Electrical Companies

	Dividend. Nom. Previous.	Last.	Price. Mar. 2.	Rise or Fall.	Yield p.c. £ s. d.
HOME ELECTRICITY COMPANIES.					
Bournemouth and Poole	1	15	76/3	—	3 18 9
City of London	1	7½	7½	37/6xd	+6d. 4 0 0
Clyde Valley	1	7	8	45/–	+2/– 3 11 1
County of London...	1	10½	10½	53/–xd	+2/– 3 19 3
Edmundson's 7% Pref.	1	7	7	33/–	–1/– 4 4 10
Do. Ord.	1	8	8	42/–	+6d. 3 16 2
Elec. Dis. Yorkshire	1	9	9	44/6	+1/6 4 1 0
Elec. Fin. and Securities	1	12½	12½	3	— 4 3 4
Elec. Supply Corporation ...	1	11	11	55/9	— 3 19 2
Lancs Light and Power	1	7½	7½	37/6	+6d. 4 0 0
Lond. Assoc. Electric	1	—	7	34/–	–1/– 4 2 4
London Electric	1	7	8	38/–	–6d. 4 4 3
London Power Deb. Red. ...	Stock	5	5	106½xd	+2 4 14 0
Metropolitan	1	10	10	49/6	+6d. 4 1 0
Midland Counties	1	7½	8	2xd	+2/– 4 0 0
Mid. Elec. Power	1	8	8	41/3	— 3 17 6
North Eastern Electric Ordinary	1	6	7	34/–	+2/6 4 2 4
Do. 7% Pref.	1	7	7	34/–	— 4 2 4
Northampton	1	10	10	49/6	+9d. 4 1 0
Notting Hill 6% Pref.	10	6	6	14	— 4 5 9
North Met. Elec. Ordinary ...	1	10	10	2⅝xd	+2/– 3 18 0
Do. do. 6% Pref. ...	1	6	6	29/6	— 4 1 4
Scottish Power	1	8	8	39/6	–1/– 4 1 0
South London	1	7	7	34/–xd	— 4 2 4
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	23/6	— 6 7 8
Yorkshire Elec.	1	8	8	44/–	+2/– 3 12 9
PUBLIC BOARDS.					
Central Electricity, 1950–70 ...	Stock	5	5	112	— 4 9 3
Dc. 1955–75 ...	,,	5	5	113xd	— 4 8 6
Do. 1951–73 ...	,,	4½	4½	107	–½ 4 3 9
Do. 1963–93 ...	,,	—	3½	97	–½ 3 10 0
London Elec. Trans. Gtd. ...	,,	—	3½	88½	–2 2 16 6
London & Home Counties, 1955–75	,,	4½	4½	110	— 4 1 10
London Passenger Transport, A...	,,	—	4½	114½	+1 3 18 7
Do. do. B...	,,	—	5	119½	— 4 3 8
Do. do. C...	,,	4½	4	92	–4 4 7 0
West Midlands Joint Elec. 1948–68	,,	—	5	112½	— 4 9 0
TELEGRAPH AND TELEPHONE					
American Tel. & Tel.	$160	9	9	181⅛	–3⅛ 4 19 2
Anglo-Am. Tel. Pref.	Stock	6	6	123	–4½ 4 17 7
Do. Def.	,,	1½	1½	28½	–1 5 7 2
Cable & Wireless 5½% Pref. ...	,,	4½	5½	109¾	+⅜ 5 0 3
Do. A. 7½% Ord.	,,	Nil	Nil	29⅛	+3 —
Do. B. Ord.	,,	Nil	Nil	10	+1⅞ —
Globe Tel. & Tel. Ord.	10	3½*	4½*	15⅝xd	+2/– 2 17 2
Do. do. Pref.	10	6	6	13⅞xd	–10/– 4 6 6
Great Northern Tel.	10	20	20	45	+½ 4 8 10
Marconi-Marine	1	10	7½	1⅞	— 4 0 0
Oriental Telephone Ord.	1	12*	12*	3⅛	— 3 12 6
HOME AND FOREIGN TRAMS, ETC.					
Anglo-Arg. Trams First Pref. ...	5	Nil	Nil	7/–	— —
Do. do. 2nd Pref.	5	Nil	Nil	3/9	— —
Do. do. 5% Deb.	Stock	Nil	Nil	22½	–1 —
British Electric Traction Df. Ord.	,,	5	5	1550	+75 —
Do. do. Pref. Ord.	,,	8	8	165	— 4 15 5
Brazil Traction	$100	—	70 cts.	30⅞	+⅞ —
Brit. Columbia Elec. Rly. Pce. ...	Stock	5	5	105½	— 4 14 9
Mexican Light Common	$100	Nil	Nil	6½	–1 —
Do. 1st Bonds...	$500	5	5	45½	— —
Victoria Falls Ord.	1	20	12	75/9	–6d. 3 3 6
West Riding	1	6½	10	48/9	–3/6 3 17 0
MANUFACTURING COMPANIES.					
Aron Electricity Ord.	1	10	15	2⅝	–½ 5 14 6
Assoc. Elec. Ord.	1	6	8	56/–	+5/6 2 17 2
Do. Pref.	1	8	8	38/–	–1/– 4 4 3
Babcock & Wilcox	1	8	8	51/3	–9d. 3 2 5
British Aluminium Ord.	1	7½	7½	48/–	+2/– 3 2 6
British Insulated Ord.	1	15	20	6½	+⅜ 3 4 0
Brush Ord....	Stock	Nil	Nil	60½	+7½ —
Callender's	1	15	15	4⅜	+⅛ 3 4 9
Do. 6½% Pref.	1	6½	6½	31/3	–⅛ 4 3 0
Crompton Parkinson Ord. ...	5/–	12½	12½	72/6	+⅛ —
Do. 8% Pref.	1	8	8	37/6	— 4 5 4
Electric Construction	1	3½	7	42/6	— 3 5 9
Enfield Cable Ord.	1	25	25	5⅜xd	–2/– 4 7 0
English Electric	1	Nil	Nil	34/–	+1/– —
Do. do. Pref.	1	6½	6½	26/–	— 5 0 0
Ericsson Tel.	5/–	24	20*	53/9	–⅛ 1 17 2
Ever Ready	5/–	35	35	32/6	— 5 7 8
Ferranti Pref.	1	7	7	26/3	— 5 6 8
G.E.C. Pref.	1	6½	6½	32/6	— 4 0 0
Do. Ord.	1	10	15	89/6	— 3 7 0
Henleys	5/–	30	30	21/–	+3d. 3 11 5
Do. 4½% Pref.	1	4½	4½	1⅛	— 3 15 9
India-Rubber Pref.	1	1⅜	5½	22/6	— 4 17 9
Johnson & Phillips	1	7½	10	48/9	+9d. 4 2 0
Lancashire Dynamo	1	10	20	3⅛xd	+6/– 5 1 6
Siemens Ord.	1	5	6	32/6	+⅛ 3 13 10
Telegraph Construction	£1	Nil	7½	2xd	+⅛ 3 15 0

* Dividends are paid free of Income Tax.

Published Specifications

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings will be taken

1935

12811. "Arrangements for the reception of electrically transmitted impulses and signals." Panstwowe Zaklady Tele-I-Radjotechniczne. August 7th, 1934. (460705.)

12972. "Electro-deposition of tungsten and tungsten alloys." H. H. Armstrong and A. B. Menefee. April 2nd, 1935. (460886.)

12973. "Electro-deposition of tungsten and tungsten alloys." H. H. Armstrong and A. B. Menefee. September 18th, 1934. (460840.)

15672. "Oscillatory electric circuits." Steatit-Magnesia Akt.-Ges. June 1st, 1934. (460654.)

15982. "Storage batteries." A. H. Stevens (Usl Battery Corporation). June 1st, 1935. (460656.)

18283. "Storage batteries." Kochler Manufacturing Co. June 26th, 1934. (Cognate application 18284/35.) (460658.)

18702. "Method of, and apparatus for, producing composite X-ray pictures." H. Chaoul and G. Grossman. June 29th, 1934. (460707.)

18786. "Portable electric current transformers." Allgemeine Elektricitats-Ges. June 30th, 1934. (460708.)

18899. "Electrically propelled battery vehicles." General Electric Co., Ltd., and E. H. Croft. July 2nd, 1935. (460846.)

21651. "Envelopes coated with luminescent materials adapted to enclose a source of radiation." General Electric Co., Ltd., and H. G. Jenkins. July 30th, 1935. (460850.)

21652. "Means for illumination comprising luminescent materials." General Electric Co., Ltd., and J. T. Randall and J. W. Ryde. July 30th, 1935. (Cognate application 13818/36.) (460890.)

21675. "Microphones." C. M. Streete and Shaftesbury Microphones, Ltd. July 31st, 1935. (460775.)

21691. "Television transmitter." Radioakt-Ges. D. S. Loewe. August 4th, 1934. (Cognate application 21692/35.) (460709.)

21851. "Means for illumination comprising luminescent materials." General Electric Co., Ltd., H. G. Jenkins and J. W. Ryde. August 1st, 1935. (460963.)

21855. "Electrical control apparatus." Expanded Metal Co., Ltd., and B. H. N. H. Hamilton. August 1st, 1935. (460892.)

21937. "Electric separation of coal from associated impurities." K. C. Appleyard, S. D. Pollitt and Birtley Co., Ltd. August 2nd, 1935. (460966.)

22004. "Manufacture of electric resistance elements." G. C. Gaut, B. F. Huggins and Plessey Co., Ltd. August 2nd, 1935. (460895.)

22019. "Electric primary cells and depolarizers for same." E. Nossen. August 2nd, 1935. (460898.)

22026. "Supply arrangements for cathode-ray oscillographs." Allgemeine Electricitats-Ges. August 6th, 1934. (460899.)

22123. "Switchgear and other tanks subjected to internal pressure." A. Reyrolle & Co., Ltd., and T. Williams. August 6th, 1935. (460970.)

22130. "Electric circuit-breakers." A. Reyrolle & Co., Ltd., A. Allan and T. Williams. August 6th, 1935. (460971.)

22171. "Electric signalling systems." Standard Telephones & Cables, Ltd., and E. M. S. McWhirter. August 6th, 1935. (460903.)

22172. "Electric signalling systems." Standard Telephones & Cables, Ltd., and E. M. S. McWhirter. August 6th, 1935. (460904.)

22235. "Apparatus which is heated in use, particularly electron tubes." Telefunken Ges. für Drahtlose Telegraphie. August 6th, 1934. (Cognate applications 22236/35 and 22237/35.) (460907.)

22293/4. "Containers for electrical apparatus such as electric condensers." Dubilier Condenser Co. (1925), Ltd. August 16th, 1934. (460909/10.)

22303. "Television and like systems." G. W. Walton. August 7th, 1935. (460721.)

22342. "Thermionic valve amplifiers." W. S. Percival. August 7th, 1935. (460915.)

22405. "Electric incandescent lamps, electric-discharge devices, and the like." General Electric Co., Ltd. (Patent-Treuhand-Ges. für Elektrische Glühlampen.) August 8th, 1935. (Cognate application 31421/35.) (Addition to 381142.) (460976.)

22474. "Electric fire-screens." J. H. Fearnhead. August 9th, 1935. (460723.)

22550. "Means for use in the measurement of low pressures." Callender's Cable & Construction Co., Ltd., and R. S. Vincent. August 9th, 1935. (460977.)

22716. "Vehicle lamps, searchlights, or the like for the penetration of fog." L. R. Underwood. May 28th, 1935. (Divided out of 35906/34.) (460666.)

23660. "Electrical coils or windings." S. J. Williams. August 23rd, 1935. (460783.)

24734. "Electric accumulators." Chloride Electrical Storage Co., Ltd., and A. W. Browne. September 5th, 1935. (460669.)

24974. "Electrical relays." C. Ryder, D. Pedley and Metropolitan-Vickers Electrical Co., Ltd. September 7th, 1935. (460570.)

25547. "Selectivity and fidelity control in high-frequency circuits." E. K. Cole, Ltd., and A. E. Falkus. September 14th, 1935. (460787.)

25860. "Cycle dynamos." L. T. Watson. September 18th, 1935. (460672.)

25944. "Process and apparatus for closing and sealing-off vessels such as electric incandescent lamp bulbs, containing gas under super-atmospheric pressure." Vereinigte Glühlampen und Electricitats Akt.-Ges. December 24th, 1934. (Addition to 406185.) (460861.)

26678. "Thermionic valve amplifiers." T. H. Bridgwater. September 26th, 1935. (460673.)

29210. "Electrical plug-and-socket connectors." J. B. Tucker. October 23rd, 1935. (460731.)

30701. "Carbon brushes for electrical apparatus." Morgan Crucible Co., Ltd., R. J. Perry and A. E. Wiggs. November 6th, 1935. (Cognate applications 316/36 and 28704/36.) (460800.)

32888. "Television receivers and the like." General Electric Co., Ltd., and D. C. Espley. November 27th, 1935. (460675.)

32893. "Elevator control systems." Westinghouse Electric & Manufacturing Co. November 27th, 1934. (460805.)

33180. "Amplifiers or relays for signal currents." Standard Telephones & Cables, Ltd. December 29th, 1934. (460807.)

35620. "Method of depositing zinc electrolytically." F. Maertens. January 7th, 1935. (460676.)

35945. "Miner's battery lamps and battery-charging apparatus therefor." Koehler Manufacturing Co. December 28th, 1934. (460677.)

36093. "Circuit arrangement for measuring short time intervals." M. O. Jorgensen and M. P. Weibel. January 2nd, 1935. (460737.)

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1058. "Electric incandescent lamps." General Electric Co., Ltd., and W. R. Pitkin. January 13th, 1936. (460813.)

1218. "Fluid-pressure operated electric switches." A. E. Rauwers and P. E. Voisin. January 14th, 1936. (Convention date not granted.) (460738.)

2722. "Electro-deposition of tungsten alloys." H. H. Armstrong and A. B. Menefee. September 18th, 1934. (Divided out of 460840.) (460931.)

3666. "Method and device for heating incandescent cathodes of electric-discharge vessels." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. February 8th, 1935. (460739.)

4438. "Cross-field generators." Elin Akt.-Ges. für Elektrische Industrie. February 13th, 1935. (Cognate application 4439/36.) (460933.)

5339. "Method for scanning pictures with high definition and using a narrow frequency band." E. Michaelis. February 21st, 1935. (460741.)

6854. "Illuminating devices comprising mercury-vapour discharge tubes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. March 22nd, 1935. (460743.)

7539. "Snap-action mechanism for operating electric switches, valves and other devices." T. G. Richmond and R. McLaren & Co., Ltd. March 12th, 1936. (460682.)

7720. "Apparatus for removing sheaths from electric cables." Okonite-Callender Cable Co., Inc. March 16th, 1935. (460683.)

9178. "Apparatus for diathermic treatment." Standard Telephones & Cables, Ltd. (Federal Telegraph Co.). March 27th, 1936. (460745.)

10521. "High-frequency signalling systems." Hazeltine Corporation. May 7th, 1935. (460821.)

11761. "Thermostatically operated electric switches." Diamond H Switches, Ltd. March 14th, 1936. (460748.)

14100. "Magnetron tubes and circuit arrangements incorporating the same." Telefunken Ges. für Drahtlose Telegraphie. May 18th, 1935. (460689.)

14213. "Electrical apparatus for graphically demonstrating transient electrical wave forms." British Thomson-Houston Co., Ltd. (General Electric Co.) May 19th, 1936. (460690.)

16504. "Thermionic tube electric oscillation generator circuit." C. Lorenz Akt.-Ges. June 18th, 1935. (460693.)

17979. "Manufacture of luminescent screens." General Electric Co., Ltd. June 28th, 1935. (Cognate application 22494/36.) (460756.)

18529. "Electric time switches." K. Ohreneder. July 22nd, 1935. (Cognate application 18530/36.) (460868.)

18721. "Caps, head suspension devices, or the like, having telephone ear-pieces, or the like, mounted therein." Siemens Apparate und Maschinen Ges. July 6th, 1935. (460759.)

19443. "Trunk communication cable installations provided with amplifiers." Siemens & Halske Akt.-Ges. July 20th, 1935. (460698.)

19677. "Method of manufacturing electrodes for electric condenser." Naamlooze Vennootscap Philips' Gloeilampenfabrieken. September 2nd, 1935. (460871.)

21484. "Electric arc discharge devices." British Thomson-Houston Co., Ltd. August 6th, 1935. (460875.)

21792. "Automatic safety device for flat-irons and other electrically heated devices." O. De F. Skibsted. August 7th, 1936. (460953.)

21830. "Sparking plugs." Siemens & Halske Akt.-Ges. August 29th, 1935. (460876.)

22417. "Electric-discharge devices." General Electric Co., Ltd. August 17th, 1935. (460954.)

22426. "X-ray apparatus." Westinghouse Lamp Co. August 24th, 1935. (460699.)

22836. "Electron valves." J. Pintsch Akt.-Ges. August 19th, 1935. (Addition to 452490.) (460700.)

24393. "Radio antennæ." British Thomson-Houston Co., Ltd. September 7th, 1935. (460830.)

24607. "Electric sockets." British Thomson-Houston Co., Ltd. September 10th, 1935. (406832.)

24837. "Dynamo-electric machine aggregates, especially convertors for welding purposes." Siemens Schuckertwerke Akt.-Ges. November 6th, 1935. (460879.)

25994. "Navigation-aiding radio systems." Telefunken Ges. für Drahtlose Telegraphie. September 24th, 1935. (460883.)

26665. "Apparatus for detecting the presence of mercury-vapour or other impurities in the atmosphere." British Thomson-Houston Co., Ltd. October 1st, 1935. (460835.)

28150. "Electric contacts." E. T. G. Donovan. October 16th, 1936. (460958.)

Trade Mark Applications

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from February 24th :—

Coulphone. No. 574456. Class 8. Wireless telephonic and telegraphic instruments.—Clifford Coulborn, "Ellerslie," Liverpool Road, Hulton, near Preston.

Goblin. No. 573808. Class 40. Goods manufactured from indiarubber and guttapercha.—The British Vacuum Cleaner and Engineering Co., Ltd., Parsons Green Lane, Fulham, S.W.6.

New Work for Contractors

Particulars of new works and building schemes for the use of electrical installation contractors and traders

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Aberdeen.—Houses (150), tenement type, Middlefield estate, with electrical work; A. B. Gardner, city architect. Extensions to factory, for J. Miller & Co. (Aberdeen), Ltd., Sandilands.

Accrington.—Covered market (£15,000); borough surveyor.

Arbroath.—Houses (42), Stanley Street; T. A. Hogg, burgh surveyor, Grovesend.

Atherstone.—Houses (114); D. Jennings & Son, builders.

Bangor (NORTH WALES).—Houses (300), Maesgeirchen site (£121,200); M. A. Boswell, builder.

Barking.—Fire station (£17,355); John Hansard, Ltd., 152, Great Portland Street, W.1.

Berkshire.—School, Woodley, for County E.C.

Birkenhead.—Houses (198), Hoylake Road (£82,455); E. B. J. Gould, Ltd.

Bishoptnorpe.—Houses (42), Northfield Terrace, Dringhouses; W. J. Simpson.

Brackneil (BERKSHIRE).—Estate development, Binfield Road; A. Boucher.

Bridlington.—Houses (94), St. John Street and Marton Road (£31,090); borough surveyor.

Brightlingsea.—Clothing factory at the rear of John Street, for Harvey, Ltd.

Bristol.—Extensions to works, for Thrissell Engineering Co., Ltd., Thrissell Street.

Cannock.—Houses (196), Cannock and Hednesford; surveyor, Council House, The Green.

Chelmsford.—Senior school (£52,333), and junior and infants' school and caretaker's cottage (£44,522), Moulsham, for E.C.; J. Stuart, county architect.

Cheltenham.—Houses (236), Whaddon Farm estate (£91,000); King & Co.

Chesterton (CAMBRIDGE).—Houses (39); R.D.C. surveyor.

Coatbridge.—Houses (236), East and West Waddell Park; J. Spence, burgh surveyor, Municipal Buildings.

Cockermouth.—Extensions to Dovenby Hall Mental Colony (£43,000); T. Armstrong, Ltd., builders.

Coseley.—Cinema, Vicarage Road and Birmingham Road, for S. W. Clift, 5, Union Street, Birmingham; R. Satchwell, architect, 6, New Street, Birmingham.

Coventry.—Houses (1,000), Canley; H. Ford, city engineer.

Croydon.—Extensions to works, for Mouldrite, Ltd., Factory Lane, Broad Green.

Dudley.—Houses (70), Baptist End Road, Netherton; F. H. Gibbons, borough engineer, Council House. Houses (21), Pensnett Road; Lloyd Bros. Houses (54), Red Hill estate (£17,386); J. Webb.

Dumbartonshire. — Hospital, Dumbarton, for County (£120,000); county architect.

Durham.—School, Billingham-on-Tees, for County E.C.; county architect, 34, Old Elvet, Durham.

Elland (YORKSHIRE).—Houses (40), Heathfield estate, Old Earth; U.D.C. surveyor.

Flint.—Houses (36), River-Bank, for S. A. Roberts, Albert Avenue; H. A. Jones, Colwyn Bay.

Gateshead-on-Tyne.—Houses, Dunston Garden estate and Hill Crest estate; W. Leech, builder, Coutts Road, Walkergate, Newcastle-on-Tyne.

Golborne (LANCASHIRE).—Houses, Lowton and Culcheth; A. Clough, Council Offices, Lowton, near Warrington.

Hereford.—Houses (24), Ross Road; K. C. Donaldson.

Herefordshire.—Nurses' home, mental institution, Hereford (£20,000); county architect.

Kirkcaldy.—Six-storey addition to linoleum factory, for M. Nairn & Co.; the manager.

Leeds.—Bank buildings, at junction of Vicar Lane and Eastgate, for the Martins Bank, Ltd., Water Lane, Liverpool; Kilson Parish Ledgard & Pyman, architects, Vicar Lane.

Liverpool.—Flats (48) and shops, Fontenoy Street site; director of housing, Kingsway. Extensions to multiple storey building, for the Automatic Telephone Electric Co., Ltd., Old Swann; John Williams & Sons, builders, 70, Collingwood Street.

London.—(BETHNAL GREEN).—Tenements, Minerva Street (£150,000); L.C.C. architect. (CAMBERWELL).—Extensions to Maudsley hospital (£83,375); Nox, Ltd., 55, New Bond Street, W.1. Rehousing, Sulton Street area (£127,000); L.C.C. architect. (CATFORD).—Houses and flats, Winsford Park estate, Castlands Road; New Ideal Homesteads, Ltd. (CHELSEA).—Factory, Denver Street and Mossop Street; Slater & Moberly, 46, Berners Street, W.1. (HAMMERSMITH).—Showroom and factory, Beavor Lane; E. B. Musman, 7, Cateret Street, S.W.1. Reconstruction of Haydn Park works; Wallis Gilbert & Partners, 15, Elizabeth Street, S.W.1. (ISLINGTON).—Flats (350), Highbury New Park; L.C.C. architect. (LAMBETH).—Flats (100), Colwyn Street (£62,630); L.C.C. architect. (POPLAR).—Flats (40), Glengall Road; borough engineer. (STOKE NEWINGTON).—Extensions to factory, Church Walk; Whitby's, Ltd., Eagle Street, W.C.1. Redevelopment, Hewling Street; borough engineer.

Manchester.—Houses, Crossacres, and flats, Crumpsall; city architect.

Mansfield.—Extensions to Ransom sanatorium (£30,512); H. Baggaley, Ltd.

Marple.—Bungalows and houses, Peace Farm; T. Cooper, U.D.C. surveyor.

Middlesbrough.—Houses, Brissick Farm estate (175 acres); borough engineer. Houses 32), Saltwell Road; F. Jackson, architect, Queens Square. Cinema, Parliament Road, for Thompson's Enterprises, Ltd.; Kitching & Co., architects, 21, Albert Road. Fire station and houses, Park Road South (£46,000) with electrical work; surveyor.

Morecambe.—Cinema, Heysham Road; F. Armistead. Conference hall (£50,000); borough engineer.

Murton (Co. DURHAM).—Houses, Winds Lane; G. Cairns & Sons, builders, Herrington Burn, Houghton-le-Spring.

Neath.—Houses (45), and flats, Brynhyfryd; H. A. Clarke, borough engineer, Gwyn Hall.

Newcastle-on-Tyne.—Houses, near the Coast Road; Hadden & Hillman, builders, Huddleston Road, Heaton. Houses (14), Ennerdale Road; Seymour & Carrick, builders, Eastbourne Avenue. Shops and offices, Ridley Place, for Larmour & Son; Davison, Eason & Harkness, builders, Barrack Road.

Newmarket.—Houses (30), Endsleigh Terrace, Exning Road, W. H. Eley, surveyor, Godolphin House.

Northallerton.—Houses (18), Brompton; R.D.C. surveyor.

North Shields.—Houses, Preston Colliery estate, for U. A. Ritson & Sons, Newcastle-on-Tyne; Cackett, Burns, Dick & McKellar, architects, 21, Ellison Place, Newcastle-on-Tyne.

Northumberland.—Schools, Otterburn and Rothbury, for C.C.; W. W. Tasker, County Hall, Newcastle-on-Tyne.

Nottingham.—School, Cavendish Road, Carlton; county architect, Shire Hall.

Oswestry.—Houses (50), on various sites; C. R. Barnes, R.D.C. surveyor, Council Offices, Castle View.

Perthshire.—Reconstruction of Public School, Crieff, for C.C. (£20,000); county architect, County Buildings, Perth.

Saltley.—Factory, for Southall Brothers, Ltd., Charford mills, Birmingham (£200,000); S. F. Swift & Sons, builders, Alcester Street, Birmingham.

Scunthorpe.—Civic centre, including town hall and municipal offices (£55,500); surveyor.

Sheffield.—Houses (244), Handsworth Avenue; W. & E. Sadler, Ltd. Factory, Arundel Street; Central Case Co. Factory, Clay Wheels Lane; Sheffield Cabinet Co.

Shipley.—Houses (36), Gaisby Lane; A. Greenwood.

Skelton.—Houses (53), Station Lane; Ball, Thomas and Lister, builders, Stockton-on-Tees.

Solihull.—Hotel, fronting on Damson Lane, for Mitchells & Butlers, Ltd., Cape Hill, Birmingham.

Southall.—School, Lady Margaret Road (£33,893); Spiers, Ltd.

Stirlingshire.—Building scheme (£50,000), for the Joint Committee of Stirling District Mental Hospital, Larbert; medical superintendent.

Stockport.—Cinema, café and shops, Gatley Road, Gatley, for the New Curzon Land & Development Co., Ltd., Princess Road, Flixton, Manchester; Teasdale & Sunter, architects, 4, St. Mary's Parsonage, Blackfriars, Manchester.

Stoke-on-Trent.—Houses (15), Water Street, Boothen; W. Brammer & Co. Cinema, "The Carlton," Hill Street; A. Glyn Sherwin, architect, Rectory Chambers, Newcastle-under-Lyme. Extensions and alterations to Stallington Hall Mental Deficiency Hospital (£112,000); Ball and Robinson, builders, Trent Bridge.

Stourbridge.—Cinema, 31, Hagley Road, for the Danilo Cinemas, Ltd. (£30,000); E. S. Roberts, architect, Great Charles Street, Birmingham.

Sunderland.—Two schools, Fulwell and Southwick, and remodelling of Deptford Terrace school and West Southwick school, for County E.C. (£171,766); education architect, John Street, Sunderland.

Sutton Coldfield.—Houses (31), Banners Gate Road; Shute & Adams.

Teignmouth.—Additions to the Grammar school (£18,588) with electrical work; Mr. Hague, County Hall.

Tottenham.—Houses (24), Weir Hall estate; borough engineer. Factory, Ferry Lane; Lebus Harris, Ltd., Finsbury works, Tottenham, N.17. Factory, Summerhill Road; Northwold Upholstery Co., Ltd., 154, West Green Road, N.15.

Tunstall.—Houses (76), near High Street, Sandyford; G. H. Wignall.

Tynemouth.—Public library; borough engineer.

Wakefield.—Shops and stores, Kirkgate, for Boots Pure Drug Co., Ltd.; P. J. Bartlett, architect, Station Street, Nottingham.

Warwickshire.—School, The Lickey, Barnt Green, for E.C.; A. C. Bunch, architect, Shire Hall, Warwick.

West Bromwich.—Factory, Albion Road; Hill's Patent Glazing, Ltd.

Wigan.—Extensions to Girls' High school, for E.C. (£25,000); J. Dove, borough engineer.

Wingate.—Hotel, for J. W. Cameron and Co., Ltd.; J. W. English, architect, 4, Hart Road, West Hartlepool.

Wolverhampton.—Cinema and shops, Wolverhampton-Birmingham main road, for A. Hopkins, 2, Beaconsfield Avenue.

Wood Green.—Factory and offices, Cline Road; Tuscan Engineering Co., 1, Elliott's Place, N.1. Eight shops and flats, Bounds Green Road; S. Stern, 1, Ravensfield Burroughs, N.W.4.

Worcester.—Rebuilding the St. John's Cinema (£25,000); R. Satchwell, architect, 6, New Street, Birmingham.

York.—Baths, Skeldergate (£61,000); city architect.

Electric Power Commission for Quebec

A Reuter message from Quebec states that the establishment of a Hydro-Electric Power Commission for the Province of Quebec was forecast in a speech from the Throne read at the opening of the second session of the Legislature on February 24th. The speech revealed that the Government will ask the Legislature "To create an organisation with power to install certain electric plants which shall remain the property of the Province and the exploitation of which, independent of electricity companies and political patronage, shall be effective in the general interest of the public." The announcement was made a day after Mr. Drouin, Minister of Lands and Forests, resigned from the Cabinet because the Government had declined to set up an Electricity Commission similar to one in Ontario.